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Vol. II

TRANSCRIPT OF RECORD

Supreme Court of the United States

OCTOBER TERM, 1940

No. 9

THE SCHRIBER-SCHROTH COMPANY,
PETITIONER,

vs.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION

No. 10

THE ABERDEEN MOTOR SUPPLY COMPANY,
PETITIONER,

vs.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION

No. 11

THE F. E. ROWE SALES COMPANY, PETITIONER,

vs.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION

ON WRITS OF CERTIORARI TO THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT

PETITION FOR CERTIORARI FILED JANUARY 16, 1940.

CERTIORARI GRANTED MARCH 25, 1940.

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Orders allowing certiorari	2414	935

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[fols. 1283-1290] **PLAINTIFFS' EXHIBIT No. 2**

Gulick Patent in Suit

U. S. Patent No. 1,815,733, July 21, 1931,

To E. J. Gulick

Piston

(Filed January 27, 1934)

529

July 21, 1931. E. J. GULICK 1,815,733

PISTON

Filed Nov. 30, 1917

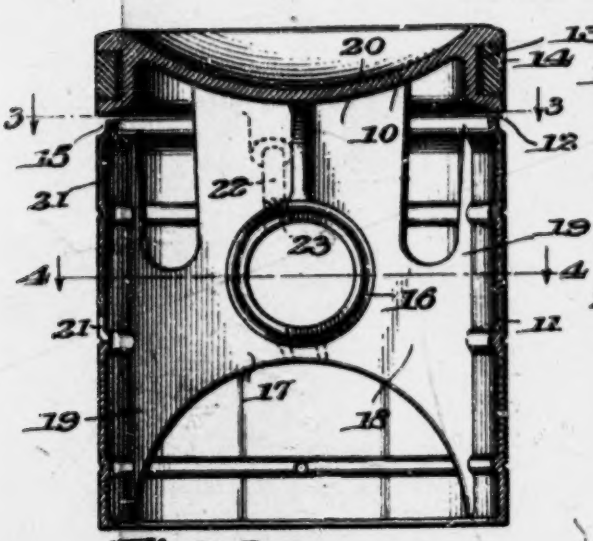


Fig. 1.

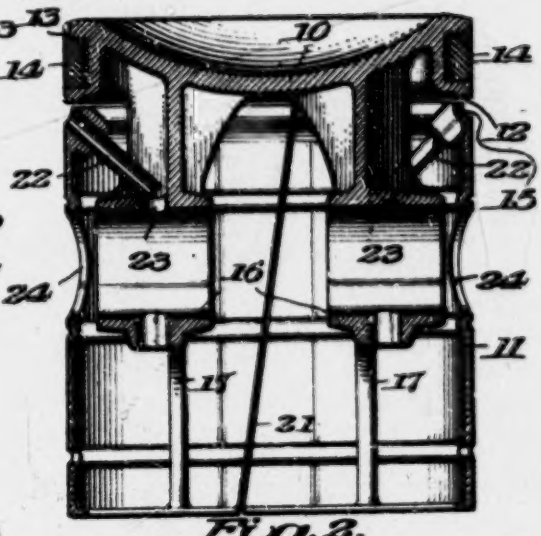


Fig. 2.

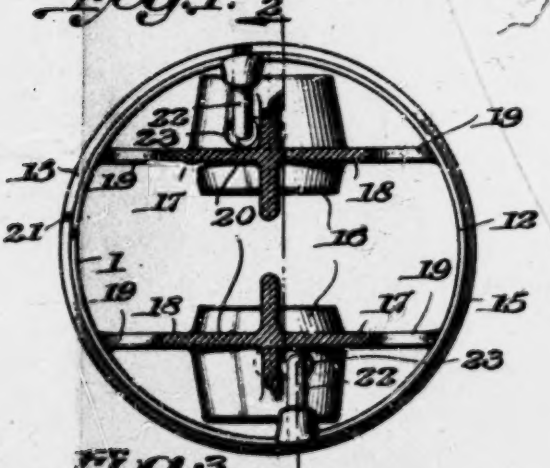


Fig. 3.

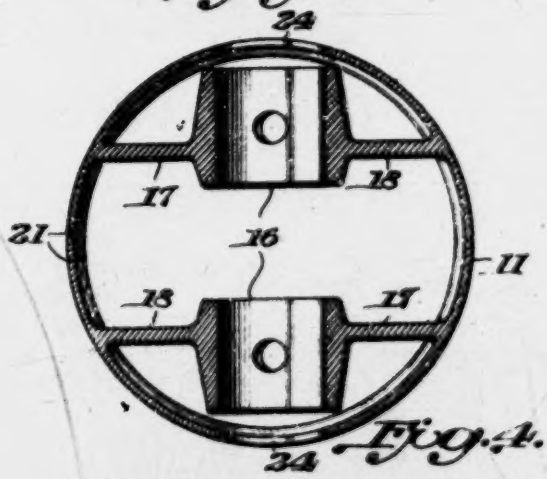


Fig. 4.

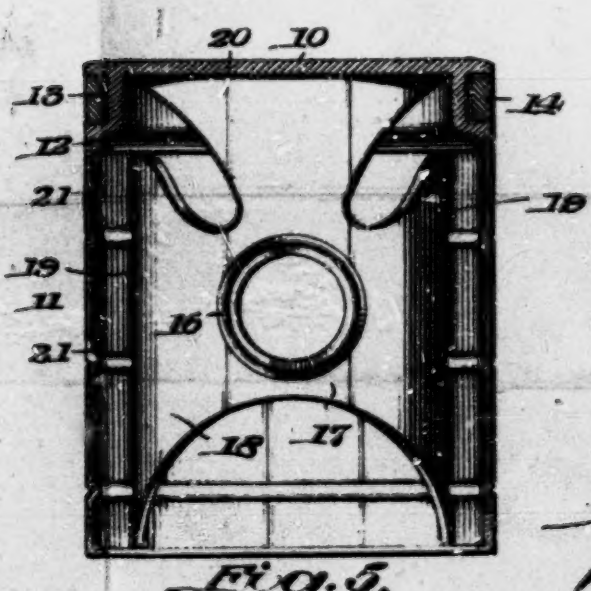
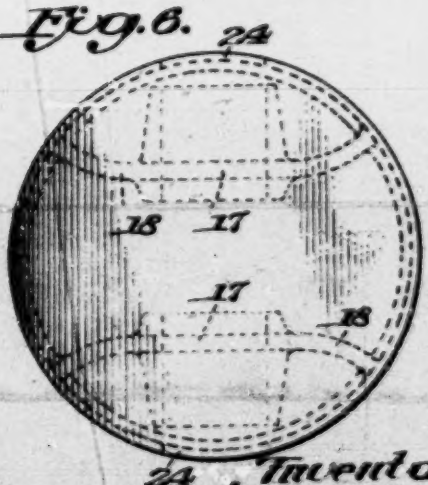


Fig. 5.

Fig. 6.



Inventor:
Edward J. Gulick,
By Wilson T. Betts, Atty

Patented July 21, 1931 1,815,733

UNITED STATES PATENT OFFICE

EDWARD J. GULICK, OF ELKHART, INDIANA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE CLEVELAND TRUST COMPANY, A CORPORATION OF OHIO

PISTON

Application filed November 30, 1917. Serial No. 204,981.

This invention relates to pistons.

One of the objects of the present invention is to provide a piston which will not expand against the cylinder wall to such an extent as to seize or stick.

Another object of the invention is to provide a piston with a skirt or guide portion slightly separated from the head of the piston and split longitudinally so that it will not expand in circumference with a force great enough to cause the piston to stick in the cylinder.

Another object of the invention is to provide a piston with improved lubricating means for the piston pin bosses.

Another object of the invention is to rigidly support the piston pin bosses of a piston from the piston walls against mechanical load thrust from the connecting rod without interfering with the yielding characteristics of the skirt in response to cylinder wall pressure.

Other objects of the invention will appear from the following description taken in connection with the drawings which form a part of this specification, and in which:

Fig. 1 is a longitudinal sectional view through a piston embodying the invention;

Fig. 2 is similar to Fig. 1 taken at right angles thereto, being on the line 2—2 of Fig. 3;

Fig. 3 is a transverse section substantially on the line 3—3 of Fig. 1;

Fig. 4 is a transverse section on the line 4—4 of Fig. 1;

Fig. 5 is a view similar to Fig. 1, showing a slightly different form of piston embodying the invention; and

Fig. 6 is a top view of the piston shown in Fig. 5.

Referring to the drawings, 10 represents the head portion of a piston and 11 is the skirt or guide portion which is shown as separated at its periphery from the head leaving an annular slit or opening 12 therebetween. The head portion of the piston is provided with an annular groove 13 for a piston ring 14, and the upper end of the skirt portion 11 is formed with a recess shown in the form of an annular groove 15 for the purpose of collecting the oil that may be scraped from the cylinder during the reciprocation of the piston.

The piston is also provided with a pair of separated piston pin bosses 16 which are formed with integral supporting flanges 17 extending around the bosses and arranged intermediate their ends. These flanges extend laterally of their respective bosses in the form of webs 18 which integrally connect with the wall of the guide portion 11 as shown in the drawings. Since there are two of these webs or walls 18 for each of the bosses 16 there are therefore four connections of the webs 18 to the skirt or guide portion 11. These connections are in the four longitudinal lines as shown at 19.

The flanges 17 also extend upwardly from the bosses in the form of webs or walls 20 leading to the head 10 and thereby connecting the bosses with the head. Thus, the bosses are connected to both the head and the skirt so that the latter is held in its proper position directly beneath the head as shown in Figs. 1 and 2.

In order that the skirt may not expand an undue amount when the piston is heated, as under operating conditions, the cylinder-engaging part of the guide at one side of the pin bosses which takes the angular thrust of the connecting rod during one stroke of the piston is split longitudinally as at 21. This split is slightly diagonal to prevent wearing a groove in the cylinder and it effects a complete severing of the guide wall so that the separated edges of the split are unrestrained for movement toward and from each other.

The piston is further provided with conduits 22 shown in the form of pipes extending from the recess or groove 15 at the upper end of the skirt to openings 23 in the bosses. There is shown one conduit for each boss and it will be understood that the oil collected in the groove 15 by the piston in its reciprocation is led down through the conduits 22 to the interior of the piston pin boss to thereby lubricate the bearing.

The skirt 11 is formed with openings 24 in its side registering with the openings through the bosses 16 so that the piston pin

may be inserted. As these openings are well above the bottom of the guide portion of the piston the lower end of the piston skirt is left unbroken, except for the split 21, and the arcuate parts of the skirt beneath said openings may be looked upon as joining the lower ends of the diametrically opposite cylinder-engaging parts of the guide that sustain the angular thrust of the connecting rod.

It will be seen that in addition to providing a piston with a split guide portion, the above described construction also provides a longitudinally rigid connection between the piston pin bosses and the guide portion of the piston, which construction may be used either with or without the split guide portion and separated head. The arrangement of the supporting flanges 17 between the ends of the piston pin bosses and the connections of those flanges with both the piston guide portion and the head provide a particularly strong construction, and at the same time, when the longitudinal split is used, as shown, the web structure has sufficient lateral flexibility to permit the split to close more or less under the action of the expansion forces incident to the heating of the piston.

In Figs. 5 and 6 the webs or walls 18 are slightly curved between the flanges 17 and the guide portion to thereby distribute the connection of the bosses to the guide portion more evenly around the piston. Otherwise the showing is substantially the same as in the other figures. While my piston is, of course, adapted for use in either vertical, inclined, or horizontal engines, for convenience I refer in some instances to its head end and its open end as the upper and lower ends or parts, respectively.

It will be understood further that my invention is not limited to the details of construction shown and other forms may be used without departing from the spirit or scope of the invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

1. A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses connected to the head and to the upper and lower parts of the skirt, said skirt being split longitudinally at one side between its connection to said bosses.

2. A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses integrally connected to the head and to the upper and lower part of the skirt, the outer ends of the pin bosses being spaced from the opposing parts of the skirt wall and said skirt having openings opposite the open ends of the bosses, said skirt being split longitudinally on one side between its connections to said bosses.

3. A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses integrally connected to the head and to the skirt in four longitudinal lines, the ends of said bosses being spaced from the opposing parts of the wall of the skirt, said skirt having openings therethrough opposite the open ends of the bosses.

4. A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses connected to the head, and also connected to the skirt both above and below the bosses, said skirt being split longitudinally between its connections to said bosses.

5. An integrally cast piston comprising a head, a skirt separated at its periphery from the head, and pin bosses integrally connected to the head and to the skirt at both sides and in the zone of said bosses, the bosses having their ends spaced from the opposing parts of the skirt wall, said skirt being split longitudinally between its connections to said bosses.

6. An integrally cast piston comprising a head, a skirt, separated piston pin bosses within the skirt, and an integral flange on each of said bosses intermediate its ends, said flange extending from both sides of the boss to the piston skirt and integrally united therewith in the zone of the boss, said flanges being yieldable in the direction of the piston pin boss axis and relatively rigid in the direction of their length.

7. A piston comprising a head, a skirt, separated piston pin bosses integral with the head and disposed within the skirt, and integral transversely flexible webs extending from the intermediate part of each of said bosses to the skirt wall in the zone of the boss for supporting the bosses from the adjacent part of the skirt.

8. A piston comprising a head, a skirt having its periphery separated from the head, pin bosses in the piston spaced from the wall of the skirt and conduits leading from the top of said skirt to the interior of said bosses.

9. A piston comprising a head, a skirt having its periphery separated from the head, pin bosses in the piston, the ends of said bosses being spaced from the walls of the skirt; means integrally connecting the bosses with the head and skirt, and pipes leading from the upper part of the skirt to the bosses.

10. A piston comprising a head, a skirt, separated piston pin bosses within the skirt, and an intermediate flange on each of said bosses intermediate its ends, said flange extending laterally from both sides of the boss to the piston skirt in a curve and integrally united with the skirt in the zone of the boss.

11. A piston comprising a head portion, a skirt portion, two separated pin bosses, connecting flanges in the zone of the bosses and extending from the bosses to the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the

skirt portion being entirely separated from the head portion except through the boss connections, and the skirt portion being split longitudinally of the piston to permit free expansion and contraction.

12. A piston comprising a head portion, a skirt portion, two separated pin bosses, connecting flanges in the zone of the bosses and extending from the bosses to the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the skirt portion being entirely separated from the head portion except through the boss connections, and the skirt portion being split longitudinally of the piston to permit free expansion and contraction and the skirt portion being cut away adjacent the outer ends of the piston bosses.

13. A piston having a head portion with a ring groove therein, a skirt portion having its cylinder-engaging part separated from the head portion, separated pin bosses having integral flanges connecting them with the skirt on both sides of the bosses and with the head portion respectively, said skirt being split from top to bottom on one side only of the pin bosses to permit free expansion and contraction of the skirt portion.

14. A piston for internal combustion engines comprising in combination a head portion having an end wall and a ring-packed side wall, a guide portion having an annular bearing surface at the open end thereof and diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and each separated at its upper end from the said side wall of the head portion by an unobstructed air gap, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, a pair of longitudinally disposed walls connected to said bosses and each joined at relatively widely separated points to the said cylinder-engaging parts above and below the plane of the boss axis, said walls being disposed within the maximum diameter of the piston, and integral, rigid connections extending from the bosses to the head portion.

15. A piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having on one side a cylinder-engaging part disposed to take the angular thrust of a connecting rod during one stroke of the piston, said cylinder-engaging part being separated at its upper end from said side wall by an air gap and being split longitudinally to accommodate expansion incident to the heating of the piston, a pair of separated pin bosses, and walls integrally uniting said bosses, the guide portion and the head portion.

16. A piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and each separated at its upper end from the said side wall by an air gap and one of said cylinder-engaging parts being split longitudinally from its upper edge to its lower edge, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, and walls integrally uniting said bosses, the guide portion and the head portion, said split in the cylinder-engaging face of said guide portion being disposed between the connections thereto of said walls.

17. A piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and arcuate cylinder-engaging parts joining said diemetrically opposite parts at the lower end of the guide, the said diametrically opposite parts each being separated at its upper end from the side wall of the head section by an air gap, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, a pair of transversely flexible walls integrally connected to said bosses and integrally joined to the cylinder-engaging parts at points above and below the plane of the boss axis, said walls being disposed within the maximum diameter of the piston, and connections extending from the bosses to the head portion and integral therewith.

18. A piston for an internal combustion engine cylinder comprising in combination, a head portion having an end wall and a side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to receive the side thrust of a connecting rod and arcuate cylinder-engaging parts joining said diametrically opposite parts at the lower end of the guide portion to provide an annular bearing face adjacent the open end of the piston, each of said diametrically opposite cylinder-engaging parts being separated at its upper end from the side wall of the head portion, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, a pair of spaced walls, each of which connects one of said bosses to said cylinder-engaging parts at points above and below the plane of the boss axis, one of said diametrically opposite cylinder-engaging parts being split longitudinally from its upper edge to its lower edge between its connections to said walls, and connections extending from the bosses to the head portion, whereby said piston skirt is rendered yieldable during operation in response to cylinder wall pressure.

19. A piston for internal combustion engines comprising in combination a head por-

tion having an end wall and a side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and each separated at its upper end from the said side wall by an air gap, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, a pair of walls connected to said bosses and joined to the said cylinder-engaging parts at points above and below the plane of the boss axis, and rigid, integral connections between the bosses and the head portion comprising upward extensions of said walls with strengthening ribs disposed substantially at right angles thereto.

20. A piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and each separated at its upper end from the said side wall by an air gap, spaced supporting connections between said head and guide portions, one of said cylinder-engaging parts being split longitudinally from its upper edge to its lower edge between said supporting connections, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, a pair of walls disposed within the maximum diameter of the piston and integrally connected to said bosses and to said cylinder-engaging parts and to said head portion.

21. A piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and each separated at its upper end from the said wall by an air gap and one of said cylinder-engaging parts being split longitudinally from its upper edge to its lower edge, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, and walls integrally uniting said bosses, the guide portion and the head portion, the guide structure and said walls being adapted to permit the split of the cylinder-engaging part to close more or less under the action of forces incident to the heating of the piston during operation.

22. A piston comprising in combination a head portion having an end wall and side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and each separated at its upper end from the said side wall by an air gap, a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts, a pair of walls connected to said bosses and to said cylinder-engaging parts, and connections extending from the bosses to the head section, one of the said cylinder-engaging parts being split longitudinally between the points of attachment thereto of the said walls.

23. In a piston, the combination of a head portion having an end wall and a side wall, a guide portion, a pair of separated piston pin bosses connected to the head portion, and webs disposed longitudinally of the piston integrally joining the inner parts of said bosses to the guide portion in the zone of said bosses.

24. A piston for internal combustion engines comprising a head portion, a guide portion, a pair of separated pin bosses connected to the head portion and arranged within the maximum diameter of the piston whereby the outer ends of the bosses will be out of contact with the cylinder wall, and a flange on each of said bosses near its inner end extending laterally from both sides of the boss to the guide portion in a curve and integrally united with the guide portion in the zone of the boss, said flange being disposed longitudinally of the piston.

25. An integrally formed piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a pair of separated pin bosses, and a guide portion connected to said bosses and having on one side a cylinder-engaging part disposed to take the angular thrust of a connecting rod during one stroke of the piston, said cylinder-engaging part being separated at its upper end from said side wall of the head portion by an air gap and being split longitudinally between its connections to said bosses to accommodate expansion incident to the heating of the piston.

26. An integrally formed piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having diametrically opposite cylinder-engaging parts thereof designed to take the angular thrust of a connecting rod and each separated at its upper end from the said side wall by an air gap, spaced supporting connections between said head and guide portions, one of said cylinder-engaging parts being split longitudinally between its supporting connections from its upper edge to its lower edge, and a pair of separated pin bosses disposed on an axis between said cylinder-engaging parts.

27. A one-piece piston with a solid end portion and a skirt portion supported therefrom by spaced integral connections and having formed in its peripheral face a transverse slot adjacent the solid end of the piston and a single longitudinal slot in the skirt between the spaced integral connections and extending from the transverse slot to the open end of the piston, said slots forming adjacent disconnected main peripheral bearing por-

tions in the skirt which are capable of unrestrained outward and inward movement, the bearing face of said piston diametrically opposite said longitudinal slot being circumferentially continuous between the spaced integral connections of the skirt to the head on that side of the skirt.

28. A one piece piston provided with a solid end portion and a skirt portion having oppositely disposed thrust bearing faces, said skirt portion having a longitudinally extending slot formed through the thickness of its wall, said slot extending from the rear edge of the skirt portion through one of said thrust bearing faces and forming adjacent disconnected parts of a thrust bearing face in said skirt portion which are capable of being moved inwardly or outwardly without restraint.

29. A piston comprising a head and body, internal yielding ribs supporting the head and body, and means on said ribs adapted to form engaging connection with operable parts for said piston.

30. A piston open at one end and having a packing ring supporting portion and a cylinder engaging portion, said cylinder engaging portion having a slot which is cut through the thickness of its peripheral wall and extending from the open end of the piston to said ring supporting portion, a pair of wrist pin bearings depended from said ring supporting portion separating from said cylinder engaging portion, and tying means extending from each of said wrist pin bearings each being co-operably connected at their opposite ends to said cylinder engaging portion.

31. A piston having a head with top and side walls in combination with a guide structure connected thereto and comprising diametrically opposite cylinder-engaging parts formed with air spaces between their upper edges and the bottom edge of the side wall of the head, wrist pin bosses between the cylinder-engaging parts, and means joining said bosses and cylinder-engaging parts together, the said joining means being resiliently yieldable and arranged not to engage the cylinder.

32. A piston closed at one end and open at its opposite end, said piston having an annular cutting formed through the thickness of its peripheral wall thereby providing a separated sleeve-like skirt which is approximately cylinder bearing in its entirety, a pair of wrist pin bearings depended from said piston end and being free from engagement with said skirt, supporting means extending from each of said bearings to said skirt, said skirt being provided with a longitudinal slot cut through the thickness of its wall between its connections to said supporting means and extending from the open end thereof to said annular cutting.

33. A piston for use in an engine cylinder comprising a head, a skirt, parts of said skirt forming oppositely positioned main bearing portions designed to take the side thrust of a connecting rod, a pair of spaced wrist pin bosses, means integrally connecting the bosses to the head, and means integrally connecting each boss to both of said opposite main bearing portions, one main bearing portion being circumferentially continuous between its connections to the bosses and the other main bearing portion being separated from the head and slit longitudinally between its connections to the bosses to render said slit main bearing portion yieldable in response to pressure from the engine cylinder during operation.

34. A piston for use in an engine cylinder comprising a head, a skirt, parts of said skirt forming oppositely positioned main bearing portions to take the side thrust of a connecting rod, a pair of spaced wrist pin bosses, means integrally connecting the bosses to the head, and means integrally connecting each boss to both of said opposite main bearing portions, one main bearing portion being circumferentially continuous between its connections to the bosses and the other main bearing portion being separated from the head and slit longitudinally its entire length between its connections to the bosses to render said slit main bearing portion yieldable in response to pressure from the engine cylinder during operation.

35. A single-piece, integral piston, comprising a head, a pair of spaced wrist pin bosses having a common axis, a skirt, and means yieldingly connecting the skirt to the head, said skirt being integral and having main cylinder bearing faces disposed on opposite sides of the axis of said wrist pin bosses, said skirt being separated from the head at the upper end of each of said bearing faces, one only of said main cylinder bearing faces being slit longitudinally between its connections to the head, whereby said head may expand and contract during operation of said piston substantially independently of said skirt portion when expansion of the skirt portion is restrained.

36. A single-piece, integrally cast piston for use in an engine, comprising a head, wrist pin bosses having a common axis, a skirt, and means connecting said head and bosses and skirt together, said skirt being integral and having a main bearing portion disposed on each side of the said wrist pin boss axis and designed to take the side thrust produced by the angularity of the connecting rod of the engine, said piston having a transverse slit through its wall on one side of the boss axis, portions of said skirt on the transversely slit side of the piston also being slit longitudinally between its connections to said bosses to provide a peripheral main bearing portion in the said transversely slit side of

said piston that is capable of yielding in response to pressure from the engine cylinder during operation of the piston.

37. A single-piece, integral piston for operation in an internal combustion engine cylinder, comprising a head, spaced wrist pin bosses, a longitudinally slitted one piece skirt that is yieldable in response to cylinder wall pressure having cylinder-engaging faces disposed at opposite sides of the axis of said bosses and designed to yieldingly engage the walls of the cylinder during operation, said head and skirt being separated at the upper end of each of said cylinder-engaging faces, and means yieldingly connecting the skirt to said head including means connecting the bosses and the skirt, said means connecting said bosses and said skirt being substantially rigid in the direction transverse to the axis of the bosses, whereby said head portion may expand and contract during operation of said piston without binding engagement of the skirt with the walls of the cylinder.

38. A single-piece, integrally cast piston for use in an engine, comprising a head, wrist pin bosses having a common axis, a skirt, and means connecting said head and bosses and skirt together, said skirt being integral and having a main bearing portion disposed on each side of the said wrist pin boss axis and designed to take the side thrust produced by the angularity of the connecting rod of the engine, said piston having a transverse slit through its wall on both sides of the boss axis, one only of said main bearing portions being slit longitudinally between its connections to said bosses to provide a peripheral bearing portion therein that is capable of yielding outward and inward movement relative to the head during operation of the piston.

39. A piston for an engine cylinder comprising a skirt, a head separated from the skirt wall around its entire periphery, said skirt being longitudinally slit to render the skirt wall yieldable on every diameter in response to cylinder wall pressure, wrist pin bosses, and means rigidly connecting said bosses to the head and yieldingly connecting said bosses to the skirt whereby said skirt is yieldable in response to cylinder wall pressure.

40. A piston for an engine cylinder comprising a cylindrical skirt that is longitudinally slit and yieldable on every diameter in response to cylinder wall pressure, a pair of wrist pin bosses having a common axis, said skirt being integral and having a main cylinder bearing portion on each side of the axis of said wrist pin bosses, a head peripherally separated from at least one of said main cylinder-bearing portions, and means connecting the bosses with the skirt, said means being yieldable in the direction of the boss axis and substantially rigid in the direction transverse to said axis, whereby said head may freely expand and contract during operation of the piston when expansion of the skirt is restrained.

41. A piston comprising a head, a pair of spaced wrist pin bosses rigidly carried by the head and having a common axis, a skirt that is separated from the head on each side of the wrist pin bosses and longitudinally slit between the bosses on one side only of the bosses to render the skirt circumferentially yielding on that side of said bosses and circumferentially non-yielding on the opposite side of said bosses, and means substantially non-yielding in the direction transverse to the boss axis connecting the bosses with the skirt.

42. A piston for an engine cylinder comprising, a head, and an integral guide portion having diametrically opposite cylinder-engaging parts thereof designed to receive the thrust of a connecting rod during operation, one of said cylinder-engaging parts being rigidly connected to the head in the direction of load thrust from the connecting rod, the opposite cylinder-engaging part being yieldable relative to the head in response to cylinder wall pressure, whereby thermal expansion of said piston will not cause it to seize in the cylinder during operation.

43. A piston for an internal combustion engine cylinder, comprising a head portion carrying packing means and an integral guide portion integral with the head portion and having diametrically opposite cylinder-engaging parts thereof designed to receive side thrust from a connecting rod, one of said cylinder-engaging parts being slit longitudinally to render it materially more yielding than the opposite cylinder-engaging part.

In testimony whereof I affix my signature.

EDWARD J. GULICK.

7

CERTIFICATE OF CORRECTION.

Patent No. 1,815,733. Granted July 21, 1931, to

EDWARD J. GULICK.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, line 33, claim 30, for the word "separating" read and separated; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of September, A. D. 1931.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

DISCLAIMER

1,815,733.—*Edward J. Gulick*, Elkhart, Ind. PISTON. Patent dated July 21, 1931. Disclaimer filed December 31, 1938, by the assignee, *The Cleveland Trust Company*.

Hereby enters this disclaimer to claims 6, 7, 17, 29, 31, 35, 37, 39, and 40 of said patent.

[*Official Gazette January 24, 1939.*]

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[fols. 1291-1298] **PLAINTIFFS' EXHIBIT No. 3**

Jardine Patent in Suit

U. S. Patent No. 1,763,523, June 10, 1930,

To F. Jardine

Piston

(Filed January 27, 1934)

June 10, 1930. F. JARDINE 1,763,523

PISTON

Original Filed March 11. 1920 2 Sheets-Sheet 1

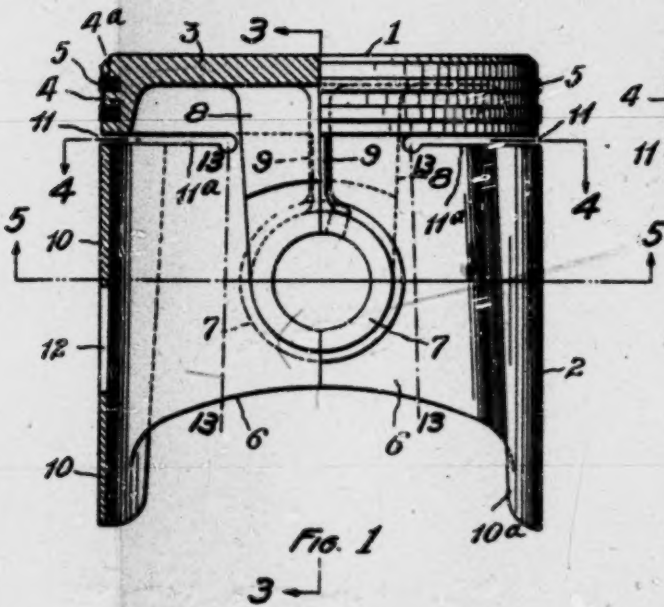

Fig. 1

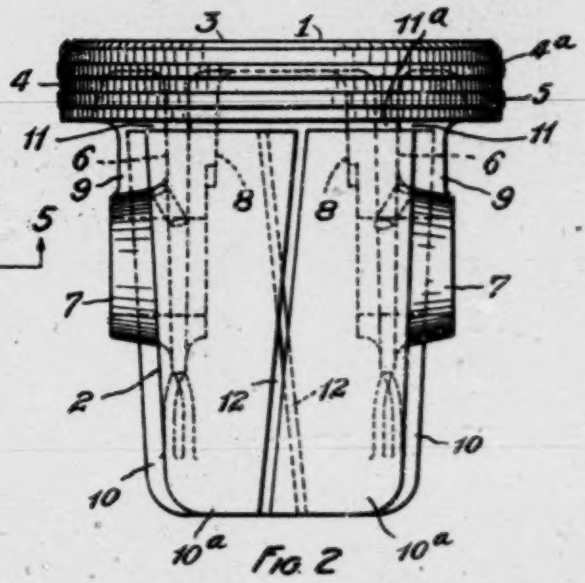

Fig. 2

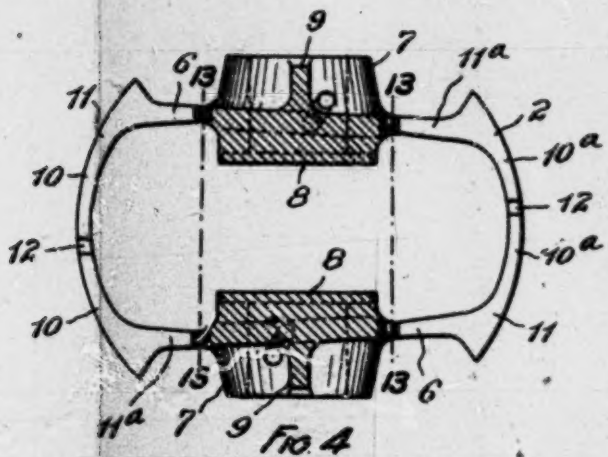

Fig. 4

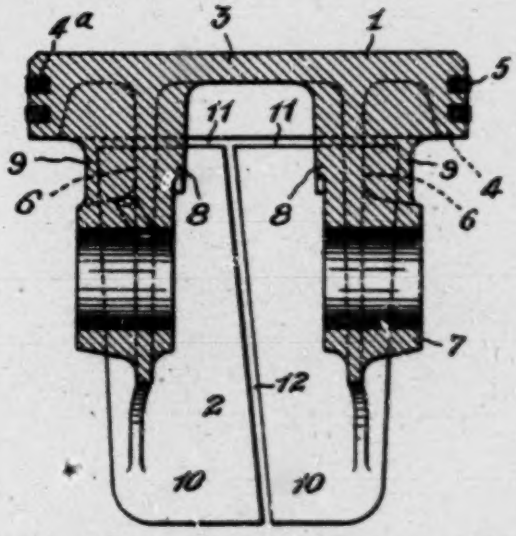

Fig. 3

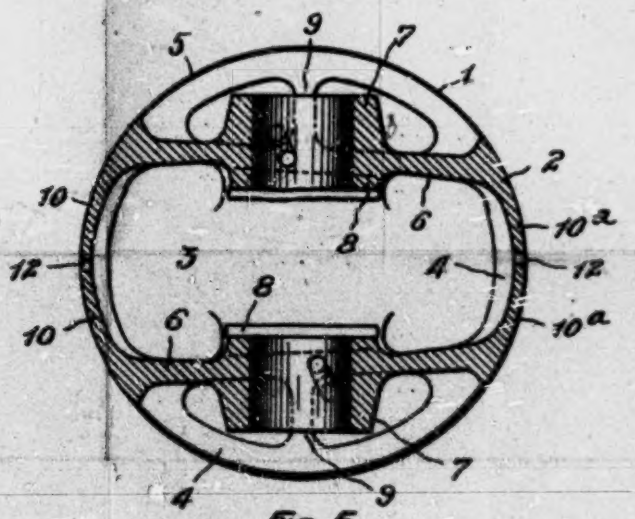

Fig. 5

INVENTOR:
Frank Jardine
BY
Kay & Kay
ATTORNEY.

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540

June 10, 1930. F. JARDINE 1,763,523

PISTON

Original Filed March 11. 1920 2 Sheets-Sheet 2

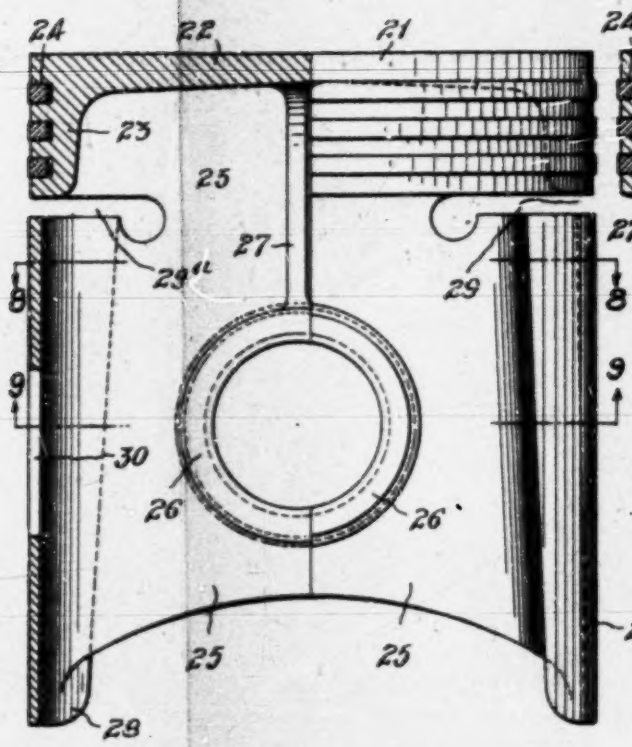

Fig. 6

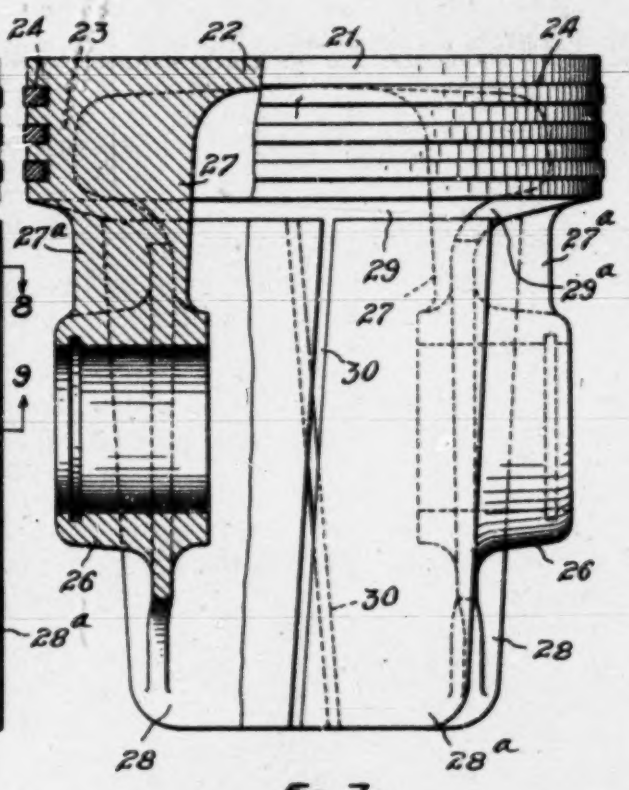

Fig. 7

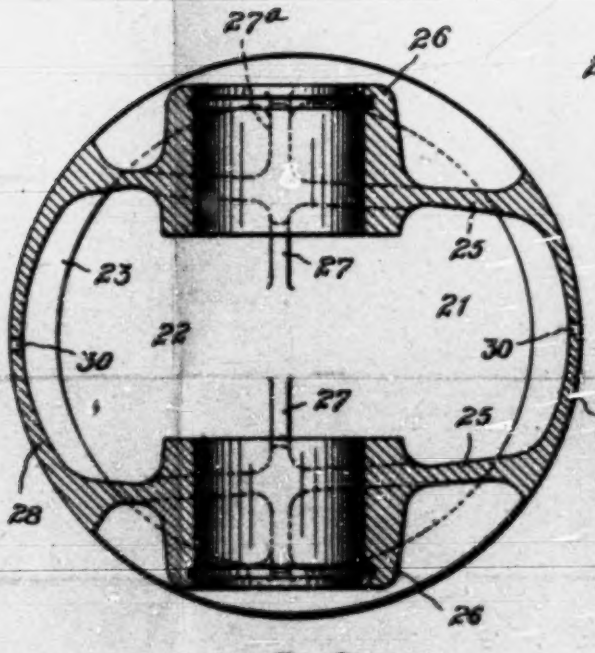

Fig. 9

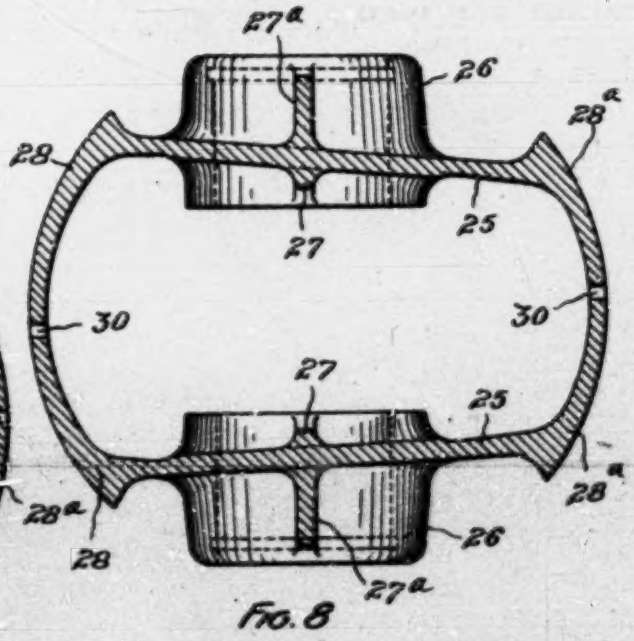

Fig. 8

INVENTOR:
Frank Jardine
BY Ray S. Fehr
ATTORNEY

Patented June 10, 1930 1,763,523

UNITED STATES PATENT OFFICE

FRANK JARDINE, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE CLEVELAND TRUST COMPANY, AS TRUSTEE, OF CLEVELAND, OHIO, A CORPORATION OF OHIO

PISTON

Application filed March 11, 1920, Serial No. 364,997. Renewed March 9, 1921. Serial No. 450,828.

My invention relates to pistons for internal combustion engines and especially to pistons formed of light weight metals or alloys.

The invention has for its chief object the construction of a light alloy piston which, with relatively small initial clearance, will operate satisfactorily at all temperatures in an engine cylinder.

Another object of the invention is to produce a piston of the character noted that will lend itself to economic methods of manufacture.

Because of the high co-efficient of expansion of suitable light alloys such as aluminum alloys, as compared with iron, it is often difficult to fit an internal combustion engine satisfactorily operable with iron pistons, with light alloy pistons so that such pistons will not be noisy and will not pump oil when cold, or will not stick or score the cylinder wall when heated. I have found that these difficulties can be overcome by constructing a piston with its skirt or guide portion supported and slotted or divided in a manner to permit deformation and deflection of parts thereof without interfering with the performance of the essential functions of the respective parts.

To facilitate an understanding of the invention two forms or embodiments thereof are described hereinafter and are illustrated in the accompanying drawings in which

Fig. 1 is a view partly in side elevation and partly in section of a piston constructed in accordance with my invention.

Fig. 2 is a side elevation of the same piston viewed at right angles to Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a section on the line 4—4 of Fig. 1.

Fig. 5 is a section on the line 5—5 of Fig. 1.

Fig. 6 is a view partly in side elevation and partly in section of a piston of modified form.

Fig. 7 is a side elevation of the same viewed at right angles to Fig. 6 and with parts broken away and shown in section.

Fig. 8 is a section on line 8—8 of Fig. 6.

Fig. 9 is a section on line 9—9 of Fig. 6.

Referring first to Figs. 1 to 5, the piston shown comprises a head portion 1 and a guide or skirt portion designated in its entirety by 2. The head portion consists of a head disc 3 and a peripheral flange 4 in which are grooves 4^a for the ordinary piston rings 5. On the lower face of the head disc 3 are formed two depending webs 6 integral with the disc. These webs carry bosses 7 which are adapted to receive the ordinary wrist pin. Ribs 8 may be provided along the webs 6 between the head disc and the bosses for strengthening the webs 6 and supporting the inner ends of the bosses. Additional ribs 9 may be formed on the outer sides of webs 6 as shown to strengthen them and to support the outer ends of the bosses.

The guide portion 2 comprises two pairs of guide segments 10 and 10^a curved to conform to the engine cylinder, one pair being located on either side of the bosses. The segments are integral with the webs 6 and are supported and connected to the head portion 1 by means of these webs. The segments at their upper ends are separated from the flange 4 of head portion 1 by slots 11 and are further isolated from the head by slots 11^a formed in webs 6. The segments of each pair are separated from one another by a longitudinally extending slot 12, said slot preferably being inclined or spirally arranged as shown. In the construction shown the guide portion formed by segments 10^a is designed to take the diagonal thrust of the piston rod during the compression stroke of the engine and as said thrust is less than the corresponding thrust during the explosion stroke, said portion 10^a is made narrower circumferentially than the other portion 10 so as to save weight.

The flange 4 of the head portion 1 has a smaller outer diameter than the guide portion 2, the diameter of the latter being only slightly smaller than the internal diameter of the cylinder in which it is to function.

In the operation of an internal combustion engine the piston usually is heated to a higher temperature than the cylinder wall and expands radially to a greater amount than the cylinder. This expansion reduces the clearance between the piston skirt or guide part and the cylinder wall and in the case of pistons not constructed according to

my invention, if the initial clearance provided is small, scoring of the cylinder walls or piston, or seizure of the piston in the cylinder may result. With my invention, however, the guide segments 10, 10ª, are capable of deformation or displacement as the piston guide parts expand, the segments being forced toward one another so as to tend to close up the slots 12. The webs 6 and guide segments preferably are so designed that this displacement of the segments 10, 10ª, is permitted by virtue of a bending of the webs 6 at points remote from the guide segments. To this end, as shown in Fig. 4, the thickness of the guide segments is increased toward the webs 6 and the webs 6 are decreased in thickness from the guide portions inward toward the bosses to points in line with the inner ends of the slots 11ª. This gives in effect a cantilever structure weakest at its support, namely, along the dotted lines 13 in Figs. 1 and 4. Thus the reaction force of the cylinder wall on the outer faces of the guide segments as the piston expands tends to cause bending of the webs 6 along said lines 13. Due to the bending of the web sections 6 and the forcing together of each pair of segments, the guide part of the piston may undergo a considerable thermal expansion without a corresponding increase in the outer diameter thereof and thus a small initial clearance can be used without danger of scoring or seizure of the piston.

By variation of the thickness and design of the webs 6 and the location of the slots 11ª therein, the force necessary to cause the guide segments 10 and 10ª to approach one another along the slot 12, or in effect to maintain the outer diameter of the piston substantially constant, can be easily regulated. The webs 6 will tend to bend along a line extending vertically downward from the ends of slots 11ª and if said slots are terminated closer to the guide segments 10, 10ª the region of bending will be moved outward correspondingly. Likewise a thickening of the webs 6 near the bosses will tend to move the point of bending or flexing closer to the guide segments 10, 10ª. An increase of the thickness of the webs 6 obviously will increase the force necessary to cause the guide segments 10, 10ª to approach one another along the slot 12.

In Figs. 6 to 9 a modified form of piston is shown. The head portion 21 is formed with a head disc 22 and a depending peripheral flange 23 in which may be formed grooves 24 for the ordinary piston rings. Depending webs 25 are formed at diametrically opposite parts of the lower edge of the peripheral flange 23. These webs carry bosses 26 for the customary wrist pin, the inner ends of the bosses being supported by ribs 27 which join the webs 25 and extend from the inner ends of the bosses 26 to the lower side of the head disc 22, while the outer ends of said bosses are supported by ribs 27ª.

On either side of the bosses 26 are formed pairs of guide segments 28 and 28ª similar to those shown in Figs. 1 to 5. These segments are united with webs 25 as shown and are separated from the flange 23 by slots 29 and further isolated from the head by slots 29ª in the walls 25. The guide segments of each pair are separated from one another by longitudinally extending slots 30.

It will be seen that this last form of construction is based upon the same principles as the first form and further detailed description is therefore unnecessary. The main difference between the last form of construction and that first described resides in the webs 35 which support the wrist pin bosses and the guide portions, said walls being joined to the head structure at the lower edge of the ring flange 23 rather than springing from the head disc as in the first form of construction.

From the foregoing description the operation of pistons embodying my improvements will readily be understood. It will be seen that an aluminum alloy piston embodying my invention can be fitted to the engine cylinder with a very small clearance and that compensation for the relatively large thermal expansion of the guide section of the piston is provided by the displacement of the guide segments which results from the reaction force of the cylinder wall on the outer faces of the guides. As above indicated the reaction force necessary to displace the guide parts and effect such compensation can readily be controlled by properly forming and proportioning the guide parts. In this connection it will be obvious to the designer that account must be taken of such factors as compression pressures, piston diameter and piston stroke as determining the lateral thrust to which the guide parts will be subjected. It is obvious that the compensating displacement of the guide parts should require a thrust great enough to insure adequate mechanical strength of the piston and small enough to obviate scoring of the piston and cylinder or seizure of the piston.

While I have shown my invention applied to the slipper type of piston as distinguished from the skirt type it is to be understood that the invention is essentially applicable to other forms of construction, the scope of the invention being indicated by the appended claims.

What I claim is—

1. In a piston for an internal combustion engine, the combination of a head having ring grooves therein, a plurality of webs integral with said head and having diametrically opposite piston pin bosses therein, a skirt integral with said webs relieved adjacent said webs and separated from the head by cir-

cumferential slots and provided with a longitudinal slot connecting the lower end of the piston with one of the circumferential slots.

2. In a piston for an internal combustion engine the combination of a head comprising a head disc and a peripheral flange having ring grooves therein, a pair of chordal webs, substantially rectangular in shape and located opposite each other in the piston, connected integrally at their upper edges to the peripheral flange of the piston, diametrically opposite wrist pin bosses, one in each of said webs, a skirt for said piston integrally connected to each of the side edges of the webs and cut away so as to expose each of the rectangular webs and the piston pin bosses from the outside of the piston, said piston being provided with circumferential slots between the skirt and head and with a longitudinal slot extending from one of the circumferential slots to the open end of the piston.

3. An internal combustion engine piston comprising a head having a depending ring flange, webs integrally cast to the ring flange and depressed within the circumference defined by the ring flange, wrist pin bosses cast in the webs, and curved guide means integrally cast to the webs and provided with a longitudinal slit disposed between the ends of the webs on one side of the piston, the outer surface of the guide means being disposed in a circumference outwardly of the outer surface of the webs and merging into the latter at included angles sufficiently great to permit the removal of a permanent mold part used to form the outer surface of the piston.

4. In a piston for an internal combustion engine, the combination of a head having a depending circumferential flange provided with ring grooves on the exterior thereof, chordal webs integral with the head and depending therefrom in opposite positions, piston pin bosses, one located in each web opposite each other, a skirt portion cut away from the head to expose the bosses in the webs and provided with curved bearing faces integral with the webs and connected to the ends of the webs opposite each other, each of said bearing faces being separated from the head except for the integral connection through the webs and one of said bearing faces having a substantially vertical slot therein.

5. In a piston for an internal combustion engine, the combination of a head having a depending circumferential flange provided with ring grooves on the exterior thereof, chordal webs integral with the head and depending therefrom in opposite positions, piston pin bosses one located in each web opposite each other, ribs integral with and substantially perpendicular to the webs joining the webs and the head, a skirt portion cut away from the head to expose the bosses in the webs provided with curved bearing faces integral with the webs and connected to the ends of the webs opposite each other, each of said bearing faces being separated from the head except for the integral connection through the webs and one of said bearing faces having a substantially vertical slot therein.

6. In a piston for an internal combustion engine, the combination of a head having a depending circumferential flange provided with ring grooves on the exterior thereof, chordal webs integral with the head and depending therefrom in opposite positions, piston pin bosses, one located in each web opposite each other, ribs integral with and substantially perpendicular to the webs joining the webs, the bosses and the head together, a skirt portion cut away from the head to expose the bosses in the webs and provided with curved bearing faces integral with the webs and connected to the ends of the webs opposite each other, each of said bearing faces being separated from the head except for the integral connection through the webs and one of said bearing faces having a substantially vertical slot therein.

7. A piston for an internal combustion engine comprising a head portion having a depending ring flange, a skirt portion, said skirt portion comprising a pair of substantially parallel webs carried by the head portion and provided with opposed wrist pin bosses, bearing portions carried by the ends of said webs and separated from the head by air gaps, the laterally outer faces of said web portions being free from laterally overhanging edge portions of the bearing faces, one of said bearing faces being provided with a longitudinal slot disposed intermediate the end portions of said bearing face.

8. In a piston for an internal combustion engine, the combination of a head havin ; a cylindrical ring flange, oppositely disposed webs integral with the flange and carrying diametrically opposite piston pin bosses, a skirt integral with said webs and cut away to expose the sides of said webs and separated from the ring flange by circumferential slits and provided with a longitudinal slit disposed between the ends of the webs.

9. In a piston for an internal combustion engine, the combination of a head comprising a disc and a peripheral flange having ring grooves therein, a pair of chordal webs connected to the flange of the head by outwardly flaring extensions, oppositely disposed wrist pin bosses in the webs, and a cylindrical skirt cut away to expose the webs and integrally connected to the ends of the latter, the skirt being separated from the head between the said webs by circumferential slits and the skirt having a longitudinally extending slit disposed between the ends of the webs on one side of the piston.

10. In a piston for an internal combustion engine, the combination of a piston head including a depending ring flange, oppositely disposed webs depending from the ring flange and disposed inwardly thereof, wrist pin bosses in the webs, and curved bearing means integrally connected to the webs and separated from the head by air gaps extending circumferentially of the piston between the ends of the webs, the said bearing means having a slit located between the ends of the webs and extending in a direction lengthwise of the piston.

11. In a piston of an internal combustion engine, the combination of a piston head having a cylindrical ring flange depending therefrom, webs integral with the flange extending convergingly inwardly of the piston from the opposite portions of the flange and then lengthwise of the piston in substantially paraliel arrangement, wrist pin bosses in the webs, and a skirt joined to the ends of the webs on opposite sides of the bosses and cut away to expose substantially all of the sides of the webs, all the foregoing parts being integrally connected together, there being circumferentially extending air gaps separating the head and skirt between the webs and a slot in one side of the skirt between the ends of the webs and extending in a direction lengthwise of the piston.

12. In a piston for an internal combustion engine, the combination of a piston head comprising a disc with a depending peripheral ring flange, a skirt separated from the head by circumferentially extending air gaps, chordal webs integrally connected at their ends to the skirt with their outer surfaces near the points of connection with the skirt diverging outwardly to merge into the outer surfaces of the skirt, wrist pin bosses integrally formed with the webs, and integral connections between the depending flange of the head and the adjacent ends of the webs, said connections extending from the flange inwardly and lengthwise of the piston and merging into the webs with outwardly diverging surfaces, the skirt having a longitudinally extending slit formed on one side thereof between the ends of the webs.

In testimony whereof, I hereunto affix my signature.

FRANK JARDINE.

[fols. 1299-1304] **PLAINTIFFS' EXHIBIT No. 4**

Maynard Patent in Suit

U. S. Patent No. 1,655,963, January 10, 1928,

To H. E. Maynard

Piston

(Filed January 27, 1934)

Jan. 10, 1928.

1,655,968

H. E. MAYNARD

PISTON

Filed Jan. 3, 1921

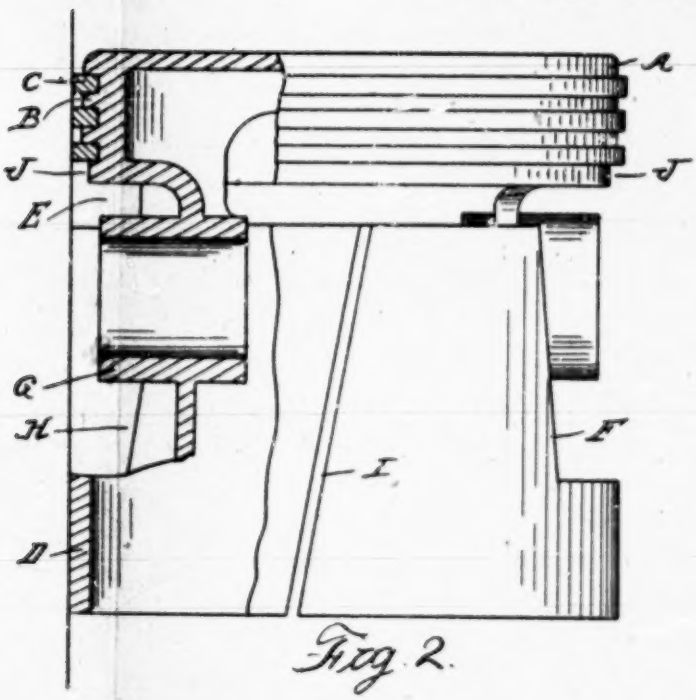

Fig. 2.

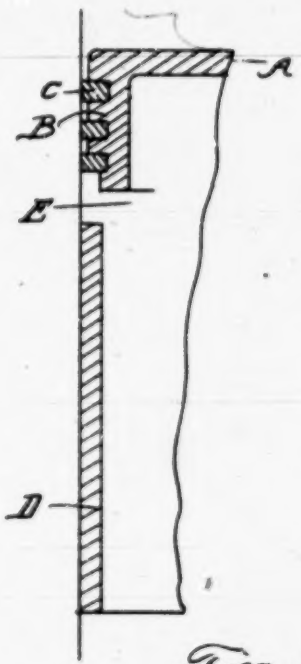

Fig. 3

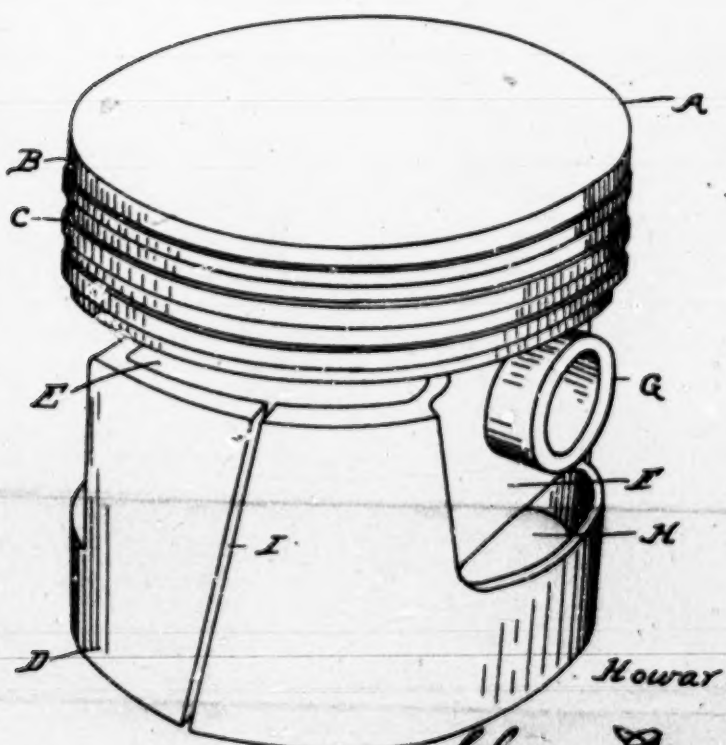

Fig. 1.

Inventor
Howard E. Maynard

By White and Hubbell & Edmonds

Attorneys

Patented Jan. 10, 1928. 1,655,968

UNITED STATES PATENT OFFICE.

HOWARD E. MAYNARD, OF DETROIT, MICHIGAN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF ONE-HALF TO CHRYSLER CORPORATION, OF HIGHLAND PARK, MICHIGAN, A CORPORATION OF DELAWARE, AND ONE-HALF TO ALUMINUM COMPANY OF AMERICA, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PISTON.

Application filed January 3, 1921. Serial No. 434,467.

The invention relates to pistons designed for use in internal combustion engines and has for its object the prevention of "pumping" of oil and the "freezing" due to excessive expansion. In the present state of the art it is usual to construct pistons with a cylindrical ring portion having a relatively large clearance with reference to the diameter of the cylinder, and a skirt portion more closely fitting the same and which holds the piston in proper alignment and prevents side slapping. To avoid sticking or freezing of this skirt, due to expansion, certain constructions of pistons have provided the skirt with a longitudinal slot therein to compensate for expansion, but there is one serious difficulty with all such constructions, viz, the tendency for the lubricating oil to work up beyond the skirt and rings and into the explosion chamber. This results in the formation of carbon and other difficulties incident thereto. With the present invention I have overcome this difficulty by arranging between the cylindrical ring portion and the skirt portion a continuous annular groove. This will receive the oil creeping past the skirt and permitting the same to drop back in the cylinder without providing any bridge for its passage to the ring portion. The result is that the cylinder will be fully lubricated, while the excess of lubricant will be scraped off by the lowermost piston rings into the annular groove, where it is permitted to drop back into the cylinder.

In the drawings:

Figure 1 is a perspective view of my improved construction;

Figure 2 is a transverse section thereof; and

Figure 3 is a similar view in plane at right angles to Figure 2.

A is the piston head having a depending cylindrical portion B grooved to receive the rings C and of a diameter to afford abundant clearance within the engine cylinder. D is a skirt, which is preferably of a diameter to closely fit the cylinder. This skirt is itself discontinuous with the cylindrical portion B of the piston, being separated therefrom by a groove E, which extends completely around the same. The connection between the two parts is formed by webs F on diametrically opposite sides of the piston, said webs extending inward from the portion B and vertically downward and having formed integral therewith the bearings G for the wrist pin. These webs are connected to the skirt on their opposite vertical edges, but are not connected thereto either at top or bottom. Thus there are formed the recesses H surrounding the bearings G with segmental skirt portions on opposite sides thereof and an annular skirt portion below said segmental skirt portions. One of the sides of the skirt between the points of attachment of the webs thereto is longitudinally slitted, as indicated at I, and this slit compensates for expansion and permits the skirt to conform itself to the cylinder.

With the construction as described, when the piston is in operation, the lubricant upon the wall of the cylinder is spread by the skirt portion of the piston and will be forced upward to the groove E at the upper end of the skirt. Further creeping is prevented by this groove and when the accumulation of oil is sufficient, it will drop back inside of the skirt. At no time is there a body of the oil adjacent to the piston rings and for this reason when the engine is upon suction stroke, any leakage past the ring cannot draw oil upward. As a further safeguard, the cylindrical portion B below the lowermost of the ring C is cut away to provide a further clearance, as indicated at J, this clearance being sufficient to prevent the bridging of the oil thereacross. Thus on each downward stroke of the piston, the lowermost ring will scrape all surplus oil from the surface of the cylinder and in the upward stroke the oil thus accumulated will pass through the groove E and downward. Any oil accumulating in the recesses H will follow down the webs F and there is no chance at any point for the accumulation of oil adjacent to the rings.

What I claim as my invention is:

1. A piston comprising a head having a cylindrical ring portion depending therefrom and a skirt portion arranged beneath said ring portion and separated therefrom by a continuous annular groove, said skirt having a pair of spaced segmental portions, webs on

diametrically opposite sides of the piston, extending inward from said cylindrical portion and vertically downward, the opposite edges of said webs being connected to the said segmental portions of the skirt, and said skirt having an annular portion below said segmental portions disconnected from the lower ends of said web.

2. A piston comprising a head having a depending cylindrical ring portion of relatively large clearance with respect to the diameter of the cylinder, and a skirt portion below said ring portion closely fitting said cylinder and separated from the ring portion by a continuous annular groove, webs on diametrically opposite sides of said piston extending inward from said cylindrical portion and downward parallel to each other, the opposite vertical edges of said webs being connected to the skirt, said skirt having an annular portion below said webs disconnected from the lower ends of said webs and there being also provided a slit completely through the skirt from the lower to the upper end thereof, and wrist pin bearings carried by said webs.

3. A piston comprising a head, a cylindrical skirt beneath said head having recesses in diametrically opposite sides thereof, parallel webs extending downwardly from said head and having the opposite side edges thereof connected to the side edges of the recesses in said skirt, separating openings being provided between the lower ends of said webs and said skirt and between the upper edges of said skirt and said head, and wrist pin bearings carried by said webs.

4. A piston comprising a head having a depending cylindrical portion provided with annular grooves, rings engaging said grooves, the cylindrical portion below the lowermost ring being cut away, a cylindrical skirt beneath the cylindrical portion of said head and having recesses in diametrically opposite sides thereof, webs extending downwardly from said head and having the opposite side edges thereof connected to the side edges of the recesses in said skirt, separating openings being provided between the lower ends of said webs and said skirt, and wrist pin bearings carried by said webs, one side of said skirt between the points of attachment of said webs thereto being slit longitudinally.

5. A piston comprising a head, a cylindrical skirt beneath said head, parallel webs extending downwardly from said head and connected to said skirt separating recesses being provided between the lower ends of said webs and said skirt and between the upper ends of said skirt and said head, one side of said skirt between the points of attachment of said webs thereto being slitted longitudinally, and wrist pin bearings carried by said webs.

6. In a piston for an internal combustion engine, the combination of a head, a plurality of webs integral with said head and having oppositely disposed wrist pin bosses mounted one in each web, a skirt integral with said webs relieved adjacent said webs to a point between the bosses and the end of the skirt, said piston being provided with circumferential slots between the piston head and skirt and with a longitudinal slot connecting the open end of the skirt with one of the circumferential slots.

7. In a piston for an internal combustion engine, the combination of a head and a plurality of webs integral with said head, diametrically oppositely disposed wrist pin bosses, one mounted in each of said webs and integral therewith, a skirt integral with said webs, relieved adjacent said webs, said relieved portion terminating between the bosses and the end of the skirt, said piston being provided with circumferential slots between the piston head and skirt, with a longitudinal slot connecting the end of the skirt with one of said circumferential slots, and with other circumferential slots between the end of the webs and the open end of the skirt.

8. In a piston for an internal combustion engine, the combination of a head provided with a disc portion and a flange portion and with ring grooves in the flange portion, a pair of substantially rectangular shaped webs integral with and depending from the flange portion of the head, a pair of oppositely disposed wrist pin bosses mounted one in each of said webs, a cross rib in said head and integral with the disc portion and flanges of the head and with said web and piston pin bosses, a skirt for said piston extending below said webs and integrally connected to the side edges of each of said webs, said piston being provided with circumferential slots between the skirt and head, with a longitudinal slot connecting one of said circumferential slots with the bottom edge of the skirt and with circumferential slots between the lower edges of the webs and the adjacent portion of the skirt.

9. A piston for an internal combustion engine, comprising a head, oppositely disposed walls depending from and connected at their upper ends to the head, bosses carried by the said walls out of direct contact with the head, and a skirt structure including two oppositely disposed bearing portions joined together by extensions below each of the said bosses and indirectly connected to the head by the said walls, the skirt structure being separated, by air gaps, from the head at its upper edge, and from the said walls below the bosses.

10. A piston for an internal combustion engine comprising a head, oppositely disposed walls depending from and connected at their upper ends to the head, the walls being depressed within the maximum diameter

of the piston, bosses carried by the said walls out of direct contact with the head, and a skirt structure, including two oppositely disposed bearing portions joined together by extensions below each of the said bosses and indirectly connected to the head by the said walls, the skirt structure being separated, by air gaps, from the head at its upper edge, and from the said walls below the bosses.

11. A piston for an internal combustion engine comprising an integral head and skirt, the said skirt consisting of oppositely disposed cylinder engaging bearing walls separated from the head by circumferential slots, a slot extending lengthwise of one of the said bearing walls, depressed walls connecting the said bearing walls, and other cylinder engaging walls connecting the first said bearing walls and separated from the said depressed walls by circumferential slots.

In testimony whereof I affix my signature.

HOWARD E. MAYNARD.

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[fols. 1305-1308] **PLAINTIFFS' EXHIBIT No. 5**

Schmiedeknecht Patent in Suit

U. S. Patent No. 1,256,265, February 12, 1918,

To V. E. Schmiedeknecht

Piston

(Filed January 27, 1934)

V. E. SCHMIEDEKNECHT.

PISTON.

APPLICATION FILED JULY 14, 1917.

1,256,265. Patented Feb. 12, 1918.

Fig-1

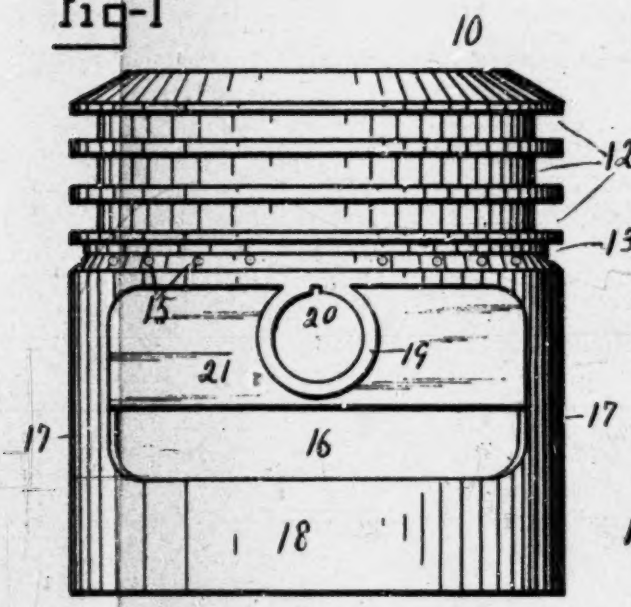


Fig-2

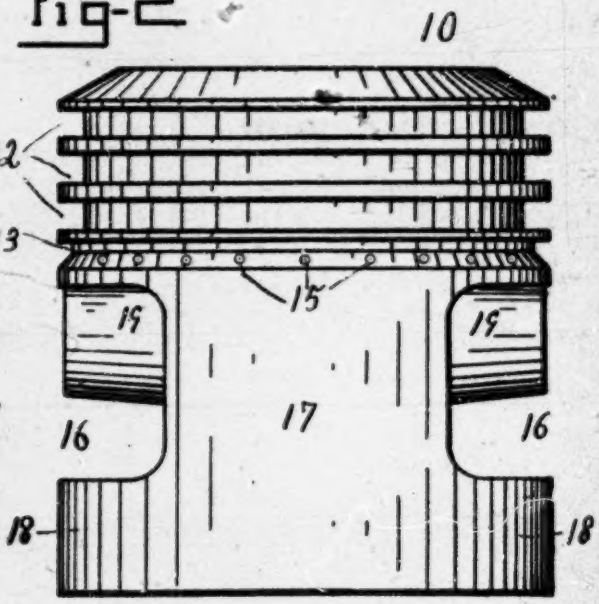


Fig-3

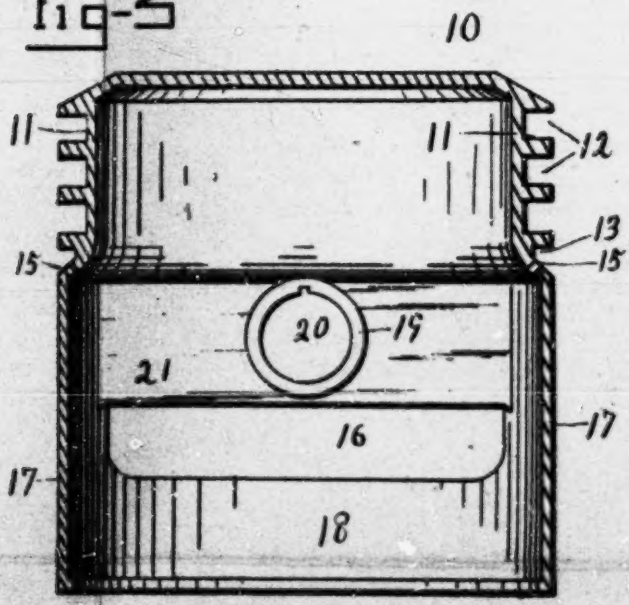


Fig-4

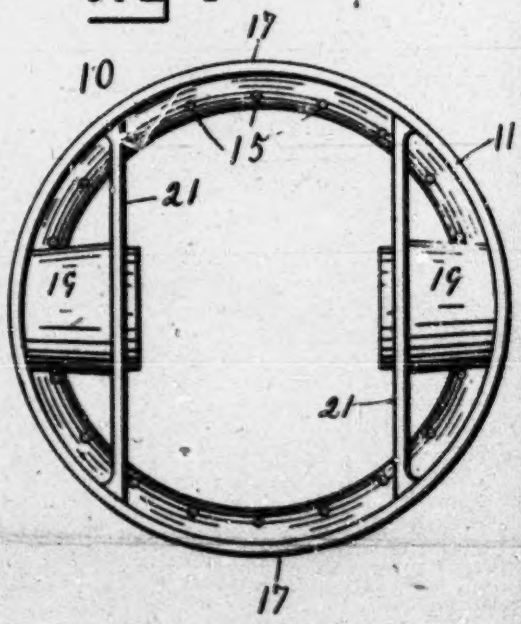
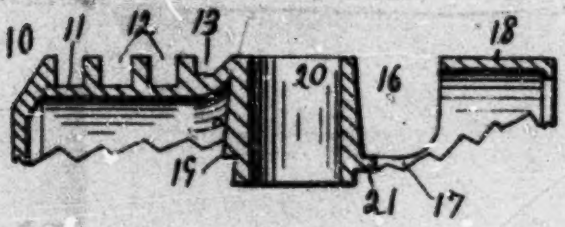


Fig-5



INVENTOR

Victor E. Schmiedeknecht.

BY

W. B. Munnell.

ATTORNEY

UNITED STATES PATENT OFFICE.

VICTOR E. SCHMIEDEKNECHT, OF LOUISVILLE, KENTUCKY.

PISTON.

1,256,265. Specification of Letters Patent. Patented Feb. 12, 1918.

Application filed July 14, 1917. Serial No. 180,511.

To all whom it may concern:

Be it known that I, VICTOR E. SCHMIEDEKNECHT, a citizen of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented a new and useful Improvement in Pistons, of which the following is a specification.

This invention relates to pistons for internal combustion motors.

It has been ascertained to be essential that pistons of internal combustion motors should be as light as possible. In accordance with accepted construction pistons are hollow cylinders, closed at one end and open at the other, a connecting rod being secured interiorly thereof intermediate of their length by means of a transverse pin. Bosses projected inward from the side walls of the piston provide bearings for the pin. It was formerly thought that a shearing stress was exerted on this pin, and that the strain was transmitted to the side walls longitudinal thereof, and that the metal being under compression, the wall could be very thin, but failure of piston walls so constructed lead to the conclusion that the connecting rod exerted a bending stress on the pin by which a lateral strain was transmitted to the walls causing them to fracture around the bosses. This discovery necessitated an increase in the thickness of the walls and the use of braces or brackets extended from the bosses to the piston head, or to the wall, but these expedients tend to increase the weight of the piston. To reduce piston weight, resort has been had to the use of metals (such as aluminum, or alloys thereof) which have a lower specific gravity than cast iron, the metal commonly used; but the coefficient of expansion of aluminum is greater than that of iron, of which motor cylinders are generally made. Consequently it is difficult to get a proper fit, for if the piston is of such size as to fit in the cylinder properly when at maximum temperature, gas and oil will leak by, when as at starting, the piston is cool.

An object of this invention is to provide a piston of minimum weight, with maximum structural strength.

To the accomplishment of the foregoing and other objects, said invention consists of the novel construction, association and relative arrangement of parts, members and features hereinafter fully described and particularly pointed out in the claims appended hereunto.

In the drawing, wherein similar reference characters designate like parts in the several views, Figure 1, is a front elevation of an embodiment of the invention: Fig. 2, a side elevation thereof: Fig. 3, a central transverse section on Fig. 1: Fig. 4, a bottom plan view: and Fig. 5, a fragmental sectional view.

Referring now in detail to the drawing, the reference character —10— designates, as an entirety, a piston, the side walls, —11— of which are provided with a plurality of grooves —12— adapted for the reception of piston rings. An oil groove —13— is located just below the groups of piston ring grooves, and from the floor of this groove, a plurality of perforations —15— lead through the wall of the piston, and serve as an avenue of escape for oil that may accumulate beneath the lower ring during the down stroke of the piston. The floor of this groove, is suitably inclined to facilitate the operation of drilling the holes 15. The only portions of the apron of the piston (*i. e.*, that portion of the wall which depends below the pin) which bear efficiently against the walls of the cylinder are those, fore and aft, which lie in the plane of the movement of the connecting rod about the pin. The side portions (those below the ends of the pin) serve to steady the piston against lateral motion. I remove portions of said apron, leaving openings —16— each of which extends circumferentially approximately one third of the distance around the piston, and longitudinally from a point just below the oil groove to within a spaced distance of the lower end of the piston, leaving a band —18— of sufficient width to give a satisfactory bearing surface. Alined bearings —19— each of which has a suitable bore —20— for the reception of a piston pin, are attached at their outer ends to the head section at the upper edge of the openings —16—, centrally thereof. The inner end of each of the bearings is supported by a transverse bridge or truss —21— joined respectively, centrally to the bearings and terminally to the edges of the portions 17 of the apron of the piston.

It is thought that the many advantages

of a piston constructed in accordance with the foregoing description will be evident to those skilled in the art.

The walls may be considerable thinner than with the usual construction, as they are not subjected to lateral strain, the bearings being supported on the inner end by a bridge supported by the side walls, which gives great rigidity to them, offering a maximum resistance to the bending strain exerted by the pin. The removal of portions of the apron also serves to reduce the weight.

It is to be understood that applicant reserves the right to resort to such changes, modifications, and variations, as may properly come within the scope of the appended claims.

Having thus described my invention so that those skilled in the art may make and use the same,

I claim:

1. A piston comprising a head section and a depending apron having oppositely disposed openings therein, alined bearings the outer ends of which are suspended from said head section within said openings, and bridges sustaining the inner ends of said bearings.

2. A piston comprising a head section, and a depending cylindrical apron, said head section being provided with a plurality of grooves for the reception of rings, and an oil groove having perforations leading from its floor to the interior of the piston, said apron having an opening below said oil groove, a bearing the outer end of which is suspended from the head section at upper edge of said opening, and a transverse bar attached respectively to the inner end of said bearing and to the apron.

3. A piston, comprising a head, and a depending apron having an opening therein, a bearing the outer end of which is attached to the head at the upper edge of said opening, and a transverse bar adapted to support the inner end of said bearing.

VICTOR E. SCHMIEDEKNECHT.

[fols. 1309-1320] **PLAINTIFFS' EXHIBIT No. 6**

U. S. Patent No. 1,402,309, Jan. 3, 1922,

To L. P. Mooers

Piston for Internal Combustion Motors

(Filed January 27, 1934)

555

L. P. MOOERS.

PISTON FOR INTERNAL COMBUSTION MOTORS.

APPLICATION FILED JUNE 2, 1917.

1,402,309. Patented Jan. 3, 1922.

3 SHEETS—SHEET 1.

Fig. 1

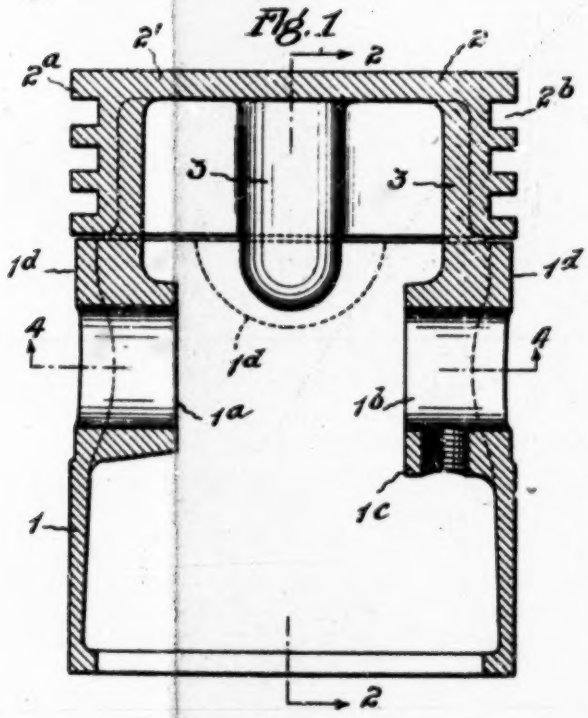


Fig. 2

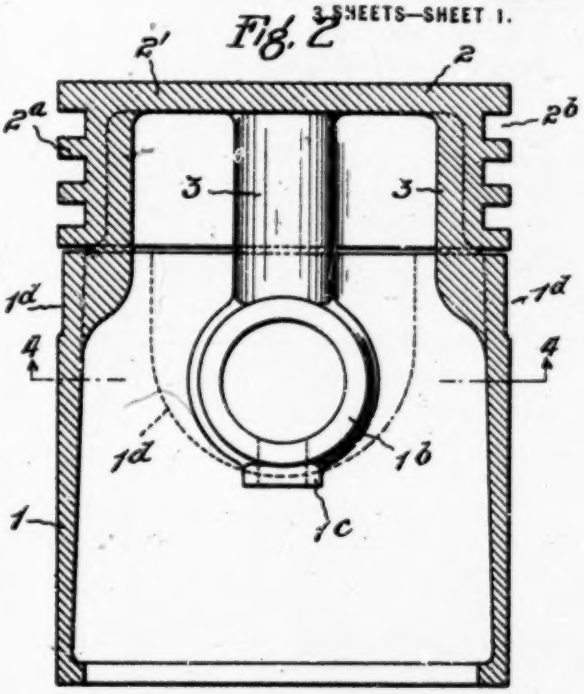


Fig. 3.

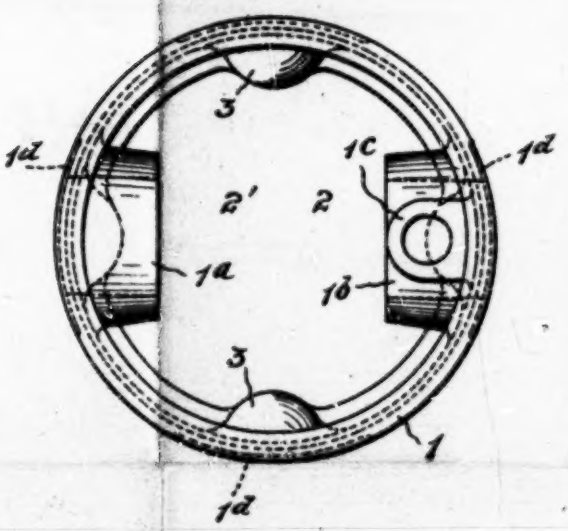
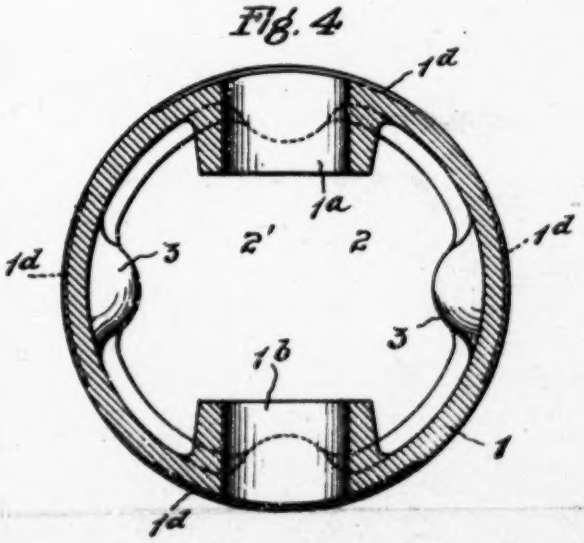


Fig. 4



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L. P. MOOERS.

PISTON FOR INTERNAL COMBUSTION MOTORS.

APPLICATION FILED JUNE 2, 1917.

1,402,309.

Patented Jan. 3, 1922.

3 SHEETS—SHEET 2.

Fig. 5

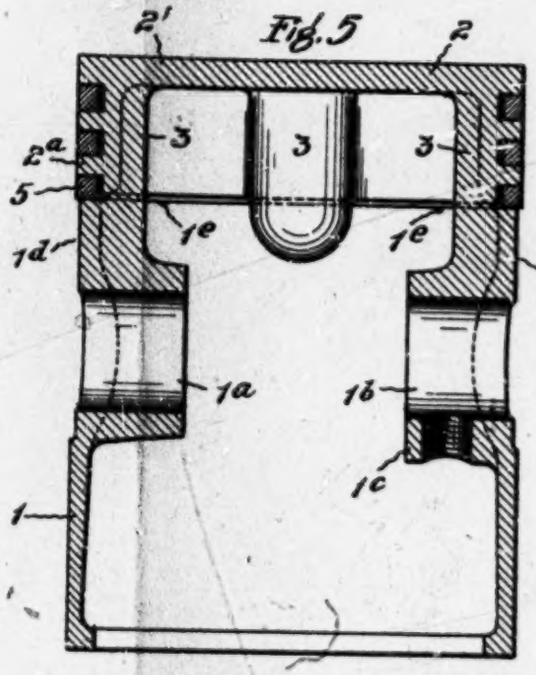


Fig. 6

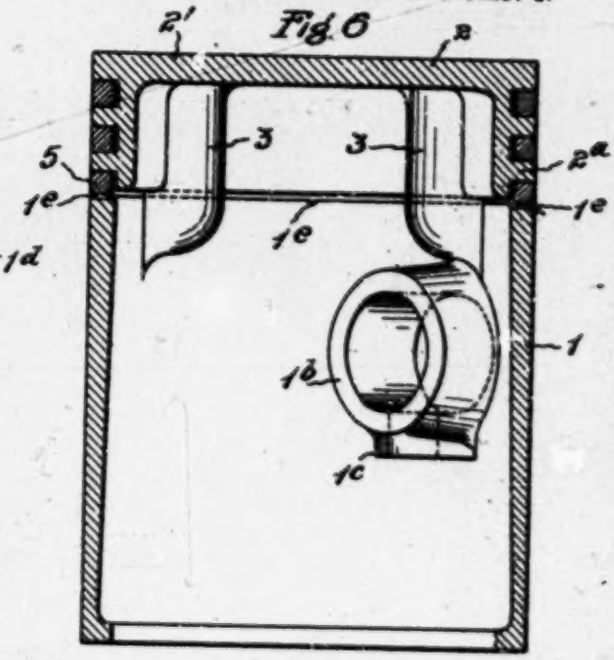


Fig. 7.

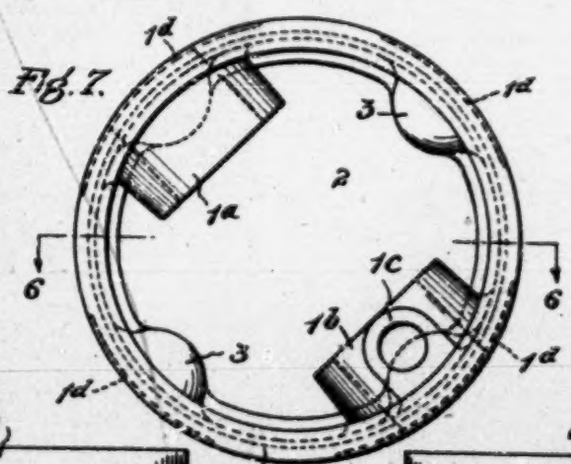


Fig. 8.

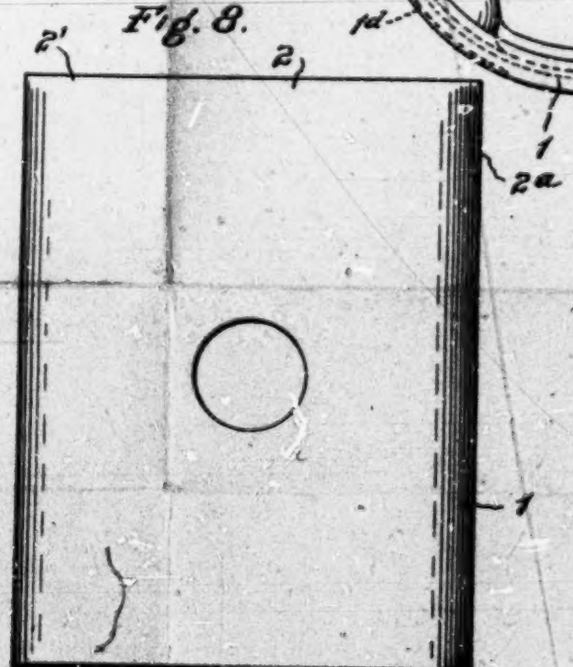
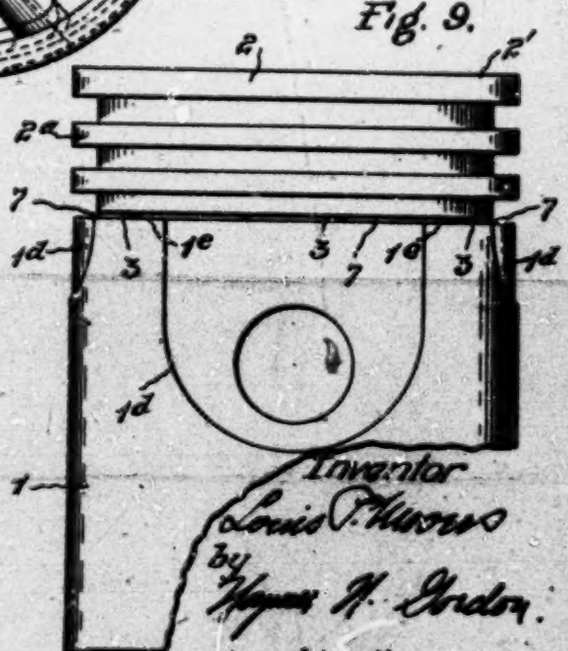


Fig. 9.



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L. P. MOOERS.

PISTON FOR INTERNAL COMBUSTION MOTORS.

APPLICATION FILED JUNE 2, 1917.

1,402,309. Patented Jan. 3, 1922.

3 SHEETS—SHEET 3.

Fig. 10

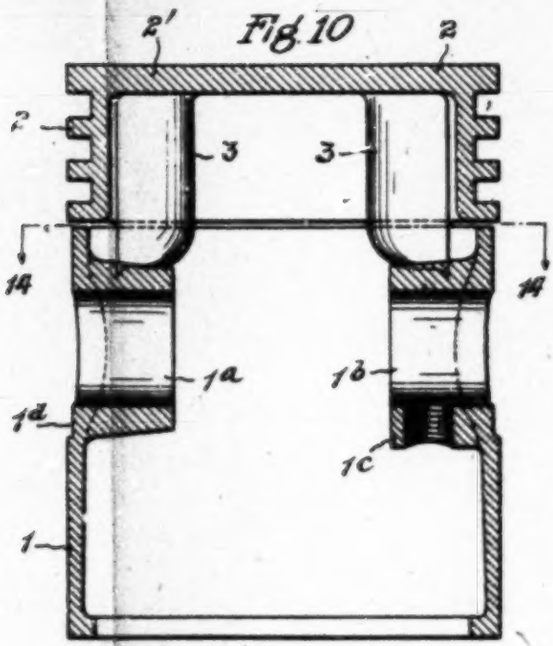


Fig. 11

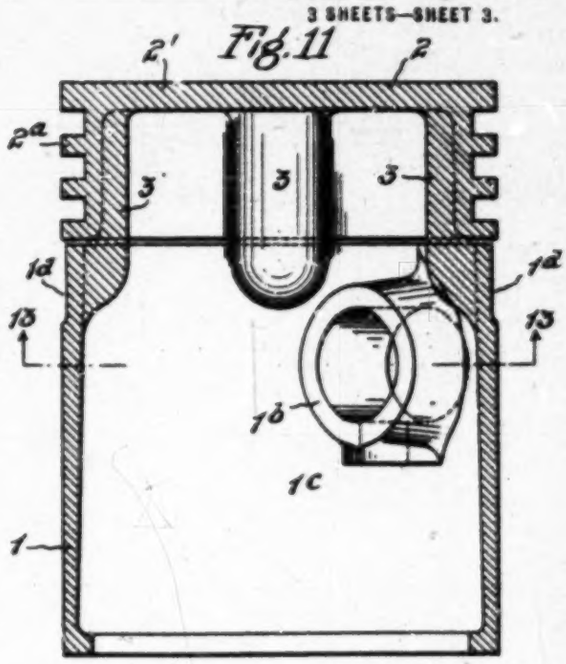


Fig. 12

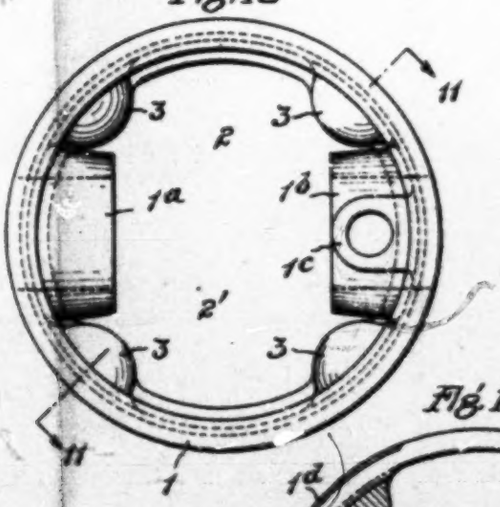


Fig. 13

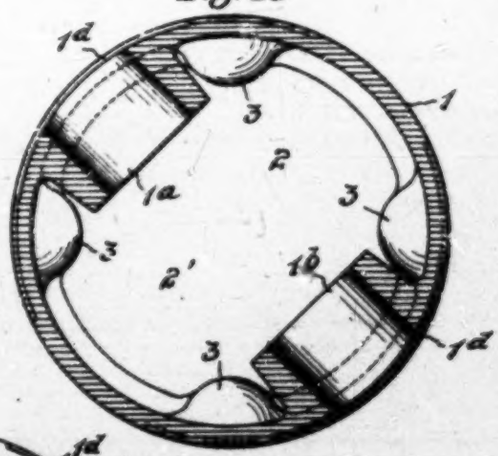
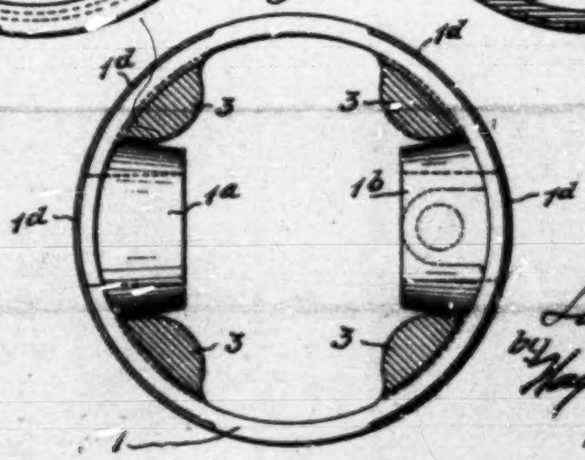


Fig. 14



Inventor
Louis P. Mooers,
by Hayes & Gordon
his attorney

UNITED STATES PATENT OFFICE.

LOUIS P. MOOERS, OF CINCINNATI, OHIO, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO THE CLEVELAND TRUST COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

PISTON FOR INTERNAL-COMBUSTION MOTORS.

1,402,309. Specification of Letters Patent. Patented Jan. 3, 1922.

Application filed June 2, 1917. Serial No. 172,880.

To all whom it may concern:

Be it known that I, LOUIS P. MOOERS, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in and Relating to Pistons for Internal-Combustion Motors, of which the following is a specification.

The invention relates to improvements in pistons which are adapted especially for use in internal combustion motors.

One of the objects of my invention is to produce a simple, light, durable and efficient skirted piston peculiarly adapted to meet the conditions which exist in an internal combustion motor cylinder, including the stresses and strains imposed upon the piston, principally during the explosion stroke, and by the high heat generated at this time, which heat must be efficiently and economically (*a*) utilized in the translation of heat into mechanical energy, and (*b*) that not translated into mechanical energy properly dissipated.

My present invention comprises improvements on the joint invention of myself and Edward O. Spillman disclosed in Letters Patent of the United States No. 1,092,870.

It contemplates simplifying the construction and manufacture of pistons of this patented type and of considerably lightening the construction as compared with the integral cast structure illustrated in the said patent. It further contemplates the disposition of the parts which go to make up the piston relative to each other so that pistons embodying one form of this invention may be made readily in permanent molds.

It further contemplates the idea of dissipating the heat from the head of the piston more effectively, as concerns the wrist pin bosses, than is the case with the construction illustrated in the said Patent No. 1,092,870.

Other objects of my invention will be obvious to one skilled in the art from the description of one or more embodiments of my idea which I have herein selected to make for the purpose of a comprehensive disclosure of my improvements to one skilled in the art.

In the drawings, Fig. 1 is a longitudinal section of a piston embodying my improvements taken through the axis of the wrist pin bosses.

Fig. 2 is a section on the line 2—2, Fig. 1.

Fig. 3 is a bottom plan view looking into one of my improved pistons.

Fig. 4 is a section on the line 4—4, Fig. 1.

Fig. 5 is a longitudinal section taken through the axis of the wrist pin bosses of a modified form of piston embodying my invention.

Fig. 6 is a section on the line 6—6, Fig. 7.

Fig. 7 is a bottom plan view of the construction of piston illustrated in Fig. 5.

Fig. 8 is a side elevation of a piston casting after being taken from the mold and before any machining is done on it.

Fig. 9 is a side elevation of said piston casting after it has been externally machined and the cut made to provide the air gap between the head and the skirt section of the piston.

Fig. 10 is a longitudinal section through the axis of the wrist pin bosses of another modified form of my invention.

Fig. 11 is a section on the line 11—11, Fig. 12.

Fig. 12 is a bottom plan view of the piston construction illustrated in Fig. 10.

Fig. 13 is a section on the line 13—13, Fig. 11.

Fig. 14 is a section on the line 14—14, Fig. 10.

In Figs. 1 to 4 inclusive, 1 is the skirt, body or guide portion of the piston. 2 is the top or piston head. 3 are columns or connectors, preferably integrally formed with the skirt 1 and head 2 for connecting these two parts of the piston together. The head preferably has an end wall $2'$ and an outer peripheral wall 2^a, the latter formed preferably with suitable piston ring grooves 2^b.

Intermediate its ends the guide portion or skirt 1 is preferably formed with inwardly extending, diametrically opposed, aligned, annular wrist pin bosses 1^a, 1^a, one of which may have a downwardly or laterally extending lug 1^c formed with a screw-threaded hole to receive in the well known manner a suitable locking bolt or screw for the wrist pin (not shown).

Tightly Bound

The upper end of the guide section or skirt is separated from the head 2 by an air gap. In the drawings, purely for the purpose of illustration, this air gap is shown wider than is necessary. The presence of this air gap or air space between the upper edge of the skirt or body section 1 and the lower edge of the peripheral portion 2^a of the piston head, insures that the heat absorbed by the piston head principally will be transmitted inwardly and downwardly through the columns 3 so that such portion of it as does reach the skirt or body by conduction will do so at points below said air gap and will be reduced in amount so as to reduce relatively the expansion of the skirt as compared with the head, thereby permitting the skirt to be fitted relatively closely to the inner walls of the cylinder. While this air gap, as above indicated has been shown, for the purpose of illustration, wider than necessary, it will be understood that my invention contemplates any sort of a separated relationship between the upper end of the skirt and the adjacent head 2 because of which heat will not be transmitted efficiently or readily from the head to the skirt other than through a connector or connectors which join those two parts of the piston together. It will be understood that this relationship might be that of a poor mechanical fit or joint which would be a poor conductor of heat, as compared with the metal of the head 2 and connectors 3, so that such heat as did pass from the head 2 to the skirt 1 would do so principally by way of the connectors 3, rather than from the head to the upper end of the skirt 1 directly.

A piston of my improved construction may be made unusually light, durable and efficient by forming it of an integral casting of a metallic alloy having a relatively low specific gravity, such for example as an alloy of aluminum, copper and magnesium, or any other metallic alloy of aluminum or other low specific gravity metal known by those skilled in the art to be suitable for the construction of cast, skirted pistons. As the alloys of metals of relatively low specific gravity, suitable for such purposes, have relatively high coefficients of expansion, some difficulty has been experienced with the use of pistons made of them in interral combustion motors, due to the necessary clearance between the piston walls and the cylinder walls to allow for such expansion; as the result of which clearance, both "piston slapping" and "oil pumping" are likely to result, as is well known to those skilled in the art. Furthermore, liquid hydro-carbons are likely to escape past the piston into the crank case and thin down the lubricant below to an undesirable degree.

It will be understood that with a piston constructed in accordance with my invention, the sleeve or skirt 1 may be constructed so as relatively snugly to fit the inner walls of the motor cylinder, whereas the head 2 may be given a considerable amount of clearance between its outer surface and the inner wall of the cylinder to allow for all necessary expansion of the head due to the high temperatures to which it is directly subjected. The fit between the skirt and the inner wall of the cylinder may be a snug sliding fit and the area of the skirt which co-acts with the inner wall of the cylinder be such as to insure against slapping or rapping of the piston against the inner wall of the cylinder. In fact objectionable piston slap, incident to the operation of numerous types of pistons, for use in internal combustion motors, substantially is eliminated, by the use of a piston constructed in accordance with my invention. Likewise oil pumping is substantially eliminated and the passage of liquid hydrocarbons from the top of the piston to the crank case is practically eliminated, resulting in minimizing of undue and troublesome carbonization and undesirable smoking among other things.

Due to the fact that the skirt or sleeve 1 is maintained relatively cool under all normal conditions, the possibilities of scoring of the inner walls of the cylinder are practically eliminated.

The construction of a piston embodying my improvements, as hereinbefore described, may be readily carried out in permanent molds, which is not true of the construction illustrated in said Letters Patent No. 1,092,870, and I have had in mind the use of such permanent molds in the design of my said improvements.

The exterior walls of the skirt near the upper end thereof, where the connectors 3 join the skirt, may be relieved or recessed, as indicated at 1^d, to allow for greater expansion at these points than will occur at other points in the same circumference of the skirt.

In the modification of my invention, illustrated in Figs. 5 to 7, inclusive, the lower piston ring groove is formed by the walls of a recess in the peripheral flange 2^a of the piston head 2 and the upper end wall of the skirt 1. In this case the lower piston ring 5 may be used as and will operate as an oil wiper and will permit the oil to pass underneath it through the grooves 1^e in the upper end wall of the skirt 1 and back into the crank case, thus assisting in keeping the motor from smoking. Where the piston rings are mounted as illustrated in Figs. 1 and 2, the air gap between the upper end of the skirt and the adjacent wall of the peripheral flange of the piston head will serve to provide an escape for oil back to the crank

case from the cylinder walls and substantially eliminate undesirable smoking of the motor.

In the modified construction illustrated in Figs. 10 to 14, inclusive, all of the columns or connectors 3 are disposed out of alignment with the wrist pin bosses 1^a. When thus disposed the amount of heat transmitted through such connectors to the wrist pin bosses will be somewhat reduced over that of a piston having the construction illustrated in Figs. 1 to 4, inclusive, as none of such connectors will transmit heat directly to either of the wrist pin bosses, there being a section of skirt between the connection of the lower end of each such connector with the skirt and the connection of the adjacent wrist pin boss with the skirt. Furthermore, with this last referred to modification the relief spaces or recesses in the outer wall of the piston adjacent the points at which the connectors 3 join the skirt will be so disposed as not to reduce any of the principal wearing surfaces of the piston against the inner wall of the cylinder.

In addition, with all the connectors 3 disposed in the regions of the pin bosses, as disclosed in Figs. 10 to 14, inclusive, the piston is especially well adapted to run with a close fit of the guide section 1 in the cylinder. It will be observed, on reference to Figs. 10, 13 and 14, that said guide section has a circumferential zone or belt extending from its upper end down to and below the pin boss openings that is characterized by a short outer diameter in line with the bosses and a long outer diameter at right angles to said bosses, this being due to the above described relief of the piston adjacent the bosses and the connectors 3. Thus when this top zone of the guide heats up the resulting expansion can be accommodated by outward movement of the relieved part of the wall and danger of seizing, as a result of close engagement between the unrelieved part of said wall and the cylinder, is obviated. This action, of course, is made possible by the fact that the upper end of the guide section is not continuously joined to the head section but, being separated from the head by the air gap, is free to take form in a measure independent of the head. The bottom part of the guide section does not attain so high a temperature as said upper zone so that no special provision for the expansion of said lower part is required.

It will be noted that pistons embodying my improvements may be made relatively light in weight, which is of material advantage in assisting in reducing the weight of the reciprocating parts of the motor.

Pistons of my improved construction will be found to operate comparatively noiselessly, smoothly and efficiently within the cylinders of internal combustion motors and with greatly reduced skirt clearances over ordinary constructions of skirted pistons.

In making my improved piston, I prefer to employ the following process. The casting may be formed in any suitable mold as a cup-shaped article, as indicated in Fig. 8. While the invention is not limited to any particular method of casting it is to be observed that the improved construction is especially well adapted for casting in a permament mold, the form and arrangement of the connectors 3 relative to the inner piston walls and the absence of any obstruction that would prevent free access to said inner walls from the open end of the piston, obviating all difficulties incident to coring. The casting being made, its outer surface may be suitably machined or ground so as to have the general external form illustrated in Fig. 9, or in Figs. 10, 13 and 14, and thereafter the head 2, including end wall $2'$ and peripheral wall 2^a may be separated from the skirt 1 by inserting a cutting tool at 7, so as to form the air gap between the lower end wall of the peripheral flange 2^a of the head and the upper end wall of the skirt. This separation of the head from the skirt may be effected before externally surfacing the casting, if desired. Any well known type of cutting mechanism may be employed for the purpose. After the cut is made the exterior of the casting will have the general appearance illustrated in Fig. 9.

To those skilled in the art of making mechanism of the class described, many alterations in construction and widely differing embodiments of my application will suggest themselves without departing from the spirit and scope thereof. My disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. An integrally cast piston comprising a head section having end and peripheral walls, a guide section separated at its upper edge from the lower edge of the peripheral wall of said head section by an air gap and provided with diametrically opposite wrist pin bosses, and section connectors which spring from the inner surface of the peripheral wall of the head section across said air gap to the upper part of the guide section in the regions of said wrist pin bosses, there being no cored-out space between any of said connectors and the adjacent side walls of the head and guide sections.

2. An integrally cast piston comprising a head section having end and peripheral walls, a guide section separated at its upper edge from the lower end of the peripheral wall of said head section by an air gap and provided with diametrically opposite wrist pin bosses, and section connectors which spring from the inner surface of the periph-

eral wall of the head section across said air gap to the upper part of the guide section in the regions of said wrist pin bosses, the wall of said guide section being exteriorly relieved opposite said connectors.

3. A piston comprising a head section having end and peripheral walls, a guide section provided with diametrically opposite wrist pin bosses, and means connecting the head and guide sections in the regions of said bosses, the upper edge of the guide section and the lower edge of the head being separated by an air gap in the regions between said connecting means, and the guide section being exteriorly relieved in the regions of the bosses and connecting means.

4. An integrally cast piston comprising a head section having end and peripheral walls, a guide section provided with diametrically opposite wrist pin bosses, and means connecting the head and guide sections in the regions of said bosses, the upper edge of the guide section and the lower edge of the head being separated by an air gap in the regions between said connecting means and the guide section being exteriorly relieved in the regions of the bosses and connecting means.

5. A piston for an internal combustion engine comprising a guide section having a pair of diametrically opposed wrist pin bosses integrally formed therewith, a head having end and peripheral walls the lower edge of the latter being spaced from the upper edge of said guide section by a practically continuous non-conducting air gap, and connectors which extend from said peripheral wall downwardly to said guide section and are integrally formed with said peripheral wall and guide section, said guide section being exteriorly relieved in the regions of said connecting means.

6. An integral cast piston for an internal combustion engine comprising a guide section having a pair of diametrically opposed wrist pin bosses, a head section having end and peripheral walls, the lower edge of the latter being separated from the upper edge of said guide section by a relatively narrow air gap extending practically around the piston, and connectors which spring from said peripheral wall of said head and the upper end of said guide section and bridge said air gap, there being no cored-out space between any of said connectors and the adjacent side walls of the head and guide sections and said guide section being exteriorly relieved in the regions of said connecting means.

7. An integral cast piston for an internal combustion engine comprising a guide section having a pair of diametrically opposed wrist pin bosses, a head section having end and peripheral walls, the lower edge of the latter being separated from the upper edge of said guide section by a relatively narrow air gap extending practically around the piston, and connectors which spring from said peripheral wall of said head and the upper end of said guide section in the regions of said wrist pin bosses and bridge said air gap, said guide section being exteriorly relieved over continuous areas each embracing the region of one of said bosses and the adjacent connecting means.

8. A piston for an internal combustion motor, comprising a guide section having a pair of diametrically opposed wrist pin bosses integrally formed with the guide section, a head having end and peripheral walls, the lower edge of the latter being separated from the upper edge of the guide section by an air gap, and means disposed out of alignment with the axes of said wrist pin bosses and extending across said air gap and providing the sole means of connection between said head and guide section.

9. A piston for an internal combustion motor, comprising a guide section having a pair of diametrically opposed wrist pin bosses integrally formed with the guide section, a head having end and peripheral walls, the lower edge of the latter being separated from the upper edge of the guide section by an air gap, and connectors between the peripheral wall of said head and the guide section formed integral therewith and radially inset with respect to said peripheral wall and providing the sole means of connection between said head and guide section.

10. An integrally cast piston comprising a head section having end and peripheral walls, a guide section separated at its upper edge from the lower edge of the peripheral wall of said head section by an air gap and provided with diametrically opposed wrist pin bosses and section connectors between the head section and the guide section in the regions of said wrist pin bosses, said connectors being disposed radially inside the air gap and there being no cored-out space between any of said connectors and the adjacent side walls of the head and guide sections.

11. An integrally cast piston comprising a head section having an end wall and a peripheral wall formed with a plurality of ring grooves, a guide section provided with diametrically opposite wrist pin bosses, and means connecting the head and guide sections in the regions of said bosses, the upper edge of the guide section and the lower edge of the head being separated in the regions between said connecting means by air gaps disposed below the lower most of said ring grooves and the guide section being exteriorly relieved in the regions of the bosses and connecting means.

12. An integrally cast piston comprising

a head section having end and peripheral walls, a guide section non-compressible circumferentially and provided with diametrically opposite wrist pin bosses, and means connecting the head and guide sections in the regions of said bosses, the upper edge of the guide section and the lower edge of the head being separated by an air gap in the regions between said connecting means and the guide section being exteriorly relieved in the regions of the bosses and connecting means.

In testimony whereof I affix my signature, in the presence of two witnesses.

LOUIS P. MOOERS.

Witnesses:

STANLEY ZULINSKI,

JOHN M. WALTER.

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[fol. 1321] PLAINTIFFS' EXHIBITS

Stipulated Digest of Assignments of Patents in Suit

* * * * * * *

Jardine Patent No. 1,763,523 (Plaintiffs' Exhibit 3)

Plaintiffs' Exhibit 3-A

From Frank Jardine to The Aluminum Castings Co.
Interest: Entire
Consideration: One Dollar and Other
Date: March 9, 1920

Plaintiffs' Exhibit 3-B

From The Aluminum Castings Company to Aluminum Manufactures, Incorporated
Interest: Entire in Jardine application S. N. 364,997
Consideration: One Dollar and Other
Date: August 1, 1921

Plaintiffs' Exhibit 3-C

From Aluminum Manufactures, Inc. to Aluminum Company of America
Interest: Entire in Jardine application S. N. 364,997
Consideration: One Dollar and Other
Date: July 1, 1924

[fols. 1322-1324] Plaintiffs' Exhibit 3-D

From Aluminum Company of America to The Cleveland Trust Company, as Trustee
Interest: All assignor owns in Jardine application S. N. 450,898 filed March 9, 1921 (renewal of S. N. 364,997)
Consideration: Pursuant to agreement of April 26, 1924
Date: May 13, 1930

* * * * * * *

(Here follows 1 photolithograph, side folio 1325-1326)

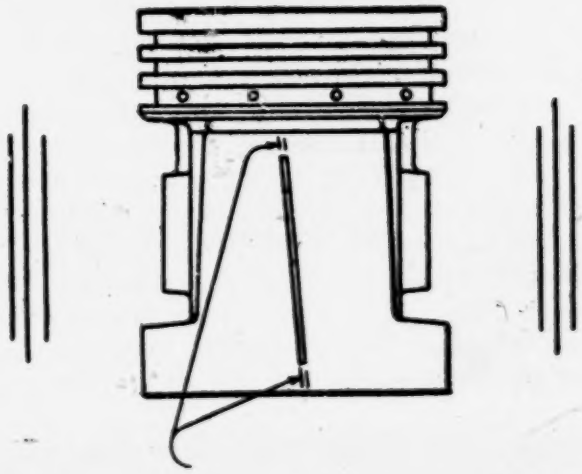
564A

FILED
JAN 27 1934
At ..... O'clock ..... M.
E. J. WENZLER, Clerk
U. S. District Court N. D. O.

Plaintiff's Exhibit C. 30

CAUTION

Pl. 7



Complete (saw thru at arrows) after wrist pin, rings, and rod are assembled—just before installing.

This slot is left unfinished so as to reduce distortion hazards in transit.

Sterling Products Corporation

Saint Louis, U. S. A.

Printed in U. S. A.

PLAINTIFFS' EXHIBIT NO. 7.
Instruction Sheet to Purchasers of Exhibit No. 1.
(Filed January 27, 1934.)

1325-1326

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[fol. 1327] PLAINTIFFS' EXHIBIT No. 11

CIRCULAR LETTER OF STERLING PRODUCTS CORPORATION—Filed January 27, 1934

Sterling Products Corporation

2916 North Market St.

Saint Louis

Announcement

GENTLEMEN:

We are specializing in a *Duplicate* Model "A" Ford Piston, for the replacement trade—IDENTICAL to that used as original equipment to all Model "A"s.

The exceptions are (1) head is centered—to facilitate finishing; (2) perpendicular slot is not completed (this to be finished after pin, rings and rod are assembled)—to reduce distortion hazards in transit; and (3) wrist pin holes are left undersize—for accurate pin fitting.

Bulletin, enclosed, will illustrate our attractive sales schedule. You will *not* find these prices equalled. The response, from the trade, on our Ford Piston proposition, is indicative of its merit.

As we are already behind on our delivery schedule—would encourage placing your order immediately for future delivery.

Yours very truly, Sterling Products Corporation.

(Received Jun 13 1930 Evans & McCoy)

[fol. 1328] PLAINTIFFS' EXHIBIT No. 13

TABULATION AS TO SALES PRODUCED BY WHITNEY—Filed January 27, 1934

Summary of Royalties Paid by Licensees Under the Piston Patent Estate

Year 1924	$23,353.08
1925	57,753.92
1926	51,284.82
1927	58,240.29
1928	209,810.43
1929	207,861.12
1930	141,982.96
1931	93,219.67
1932 (three quarters)	60,470.80
	$903,977.09

Summary of Pistons Made and Sold for the Year 1925 as Reported by Licensees Under The Piston Patent Estate

Licensee	Total Production		Net Sales		Royalties Paid
Aluminum Co. of America	831,682		815,374		
	25,349		25,251		
	1,158,464		1,108,331		
	59,443		58,775		
	1,199,988		1,176,367		
	24,313		23,670		
	900,380		874,545		
	32,489	4,232,108	32,164	4,114,477	41,144.77
Kant-Skore Piston Co.	79,540		65,929		
	121,361		117,991		
	170,393		159,541		
	165,808	537,102	163,619	497,080	4,970.8
W. M. Levett Co., W. M. Levett Corporation and W. M. Levett	251,929		248,107		
	354,769		339,646		
	314,454		303,176		
	288,344	1,209,496	272,906	1,163,835	11,638.3
National Piston Company	0		0		
	0		0		
	0		0		
	0		0		
		5,978,706		5,775,392	57,753.9

[fol. 1329]

Summary of Pistons Made and Sold for the Year 1926 as Reported by Licensees Under the Piston Patent Estate

Licensee	Total Production		Net Sales		Royalties Paid
Aluminum Co. of America	1,361,988		1,351,133		
	21,844		21,715		
	913,469		900,879		
	63,806		62,813		
	777,690		772,643		
	1,709		1,675		
	553,930		550,216		
	3,312	3,697,248	3,299	3,664,373	36,643.73
The Kant-Skore Piston Co.	353,178		344,218		
	355,372		341,827		
	164,778		161,849		
	129,953	1,003,281	119,610	967,504	9,675.04
Walker M. Levett Co., W. M. Levett Corporation and W. M. Levett	205,761		202,685		
	51,684		49,964		
	29,223		25,601		
	96,129	382,797	93,813	372,063	3,720.63
The National Piston Company, Inc.	10,379		10,379		
	41,622		41,622		
	48,289		46,445		
	36,658	136,948	26,096	124,542	1,245.42
		5,220,274		5,128,482	51,284.82

[Vol. 1330]

Summary of Pistons Made and Sold for the Year 1927 as Reported by Licensees Under the Piston Patent Estate

Licensee	Total Production		Net Sales		Royalties Paid
The Aluminum Co. of America	953,859		947,692		
	308*		303*		
	1,133,980		1,112,035		
	1,681		1,681		
	974,468		953,190		
	750		747		
	792,434	3,856,866	770,474	3,785,516	37,855.16
The Kant-Skore Piston Company	186,683		179,089		
	144,695		141,836		
	68,474		66,397		
	69,168	469,020	64,484	451,806	4,518.06
Walker M. Levett Co., W. M. Levett Corporation and W. M. Levett	108,066		103,903		
	98,217		95,656		
	59,097		54,852		
	0	265,380	0	254,410	2,544.10
The National Piston Company, Inc.	8,326		5,435		
	0		80*		
	0		0		
	0	8,326	0	5,355	53.55
John Aluminum and Brass Corporation	172,268		169,152		
	1,188,278	1,360,546	1,157,790	1,326,942	13,269.42
		5,960,138		5,824,029	58,240.29

*Figures in red.

Summary of Pistons Made and Sold for the Year 1928 as Reported by Licensees Under the Piston Patent Estate

Licensee	Total Production		Net Sales		Royalties Paid
Aluminum Co. of America	2,243,764		2,218,170		
	1,500		1,500		
	2,711,058		2,661,563		
	2,170		2,170		
	2,431,813		2,409,107		
	1,654,463		1,629,699		
	9,044,768		8,922,209		89,222.09
The Kant-Skore Piston Company	217,279		212,905		
	350,383		338,833		
	242,988		236,348		
	152,782		141,890		
	963,432		929,976		9,299.76
John Aluminum and Brass Corporation	2,662,916		2,602,739		
	2,913,717		2,847,834		
	3,300,579		3,217,904		
	2,523,961		2,460,381		
	11,401,173		11,128,858		111,288.58
		21,409,373		20,981,043	209,810.43

[fol. 1331]

Summary of Pistons Made and Sold for the Year 1929 as Reported by Licensees Under the Piston Patent Estate

Licensee	Total Production	Net Sales	Royalties Paid
Aluminum Company of America	2,325,994	2,317,294	
	2,488,086	2,473,737	
	1,849,879	1,832,064	
	985,713	958,032	
	7,649,672	7,581,127	75,811.2
Aluminum Industries, Inc.	384,196	373,429	
	664,521	655,042	
	556,408	541,319	
	212,137	206,322	
	509,684	497,925	
	2,326,946	2,274,037	22,749.3
Bohn Aluminum and Brass Corporation	3,576,703	3,521,867	
	3,663,724	3,583,220	
	2,872,192	2,803,411	
	1,062,812*	1,022,450	
	11,175,431	10,930,948	109,309.4
	21,152,049	20,786,112	207,861.1

Summary of Pistons Made and Sold for the Year 1930 as Reported by Licensees Under the Piston Patent Estate

Licensee	Total Production	Net Sales	Royalties Paid
Aluminum Co. of America	1,348,244	1,341,775	
	1,572,819	1,565,050	
	603,817	598,212	
	1,109,188	1,104,496	46,095.3
	4,634,068	4,609,533	
Aluminum Industries, Inc.	685,199	662,014	
	986,784	970,420	
	642,541	632,654	
	469,174	458,422	
	2,783,698	2,723,510	27,235.1
Bohn Aluminum & Brass Corporation	2,764,209	2,731,263	
	2,475,617	2,444,823	
	1,094,161	1,063,468	
	644,565	625,699	
	6,978,552	6,865,253	68,652.5
	14,396,318	14,198,296	141,982.9

[fols. 1332-1336]

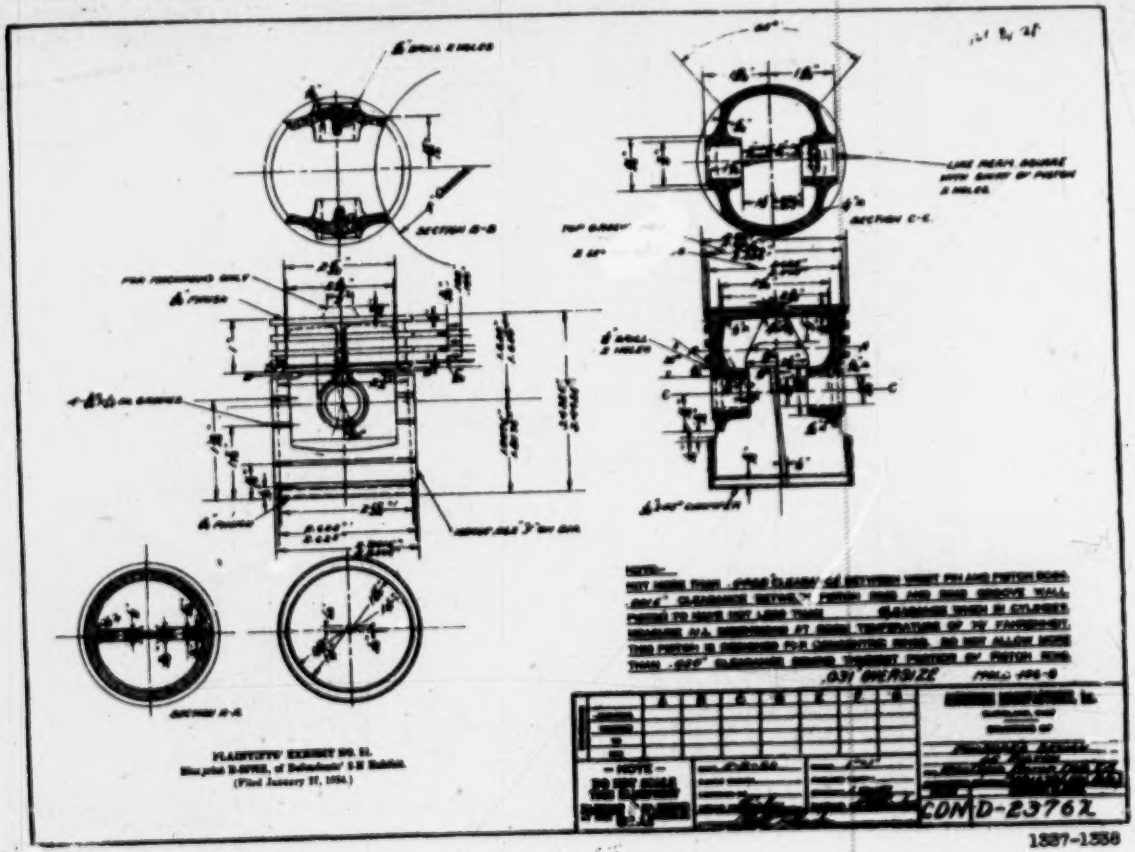
Summary of Pistons Made and Sold for the Year 1931 as Reported by Licensees Under the Piston Patent Estate

Licensee	Total Production	Net Sales	Royalties Paid
Aluminum Company of America	973,900	970,735	
	1,024,002	1,020,669	
	262,177	257,808	
	255,167	249,413	
	2,515,246	2,498,625	24,986.25
Aluminum Industries, Inc.	377,635	366,992	
	516,246	510,091	
	480,228	472,947	
	255,495	242,733	
	1,629,604	1,592,763	15,927.63
Bohn Aluminum & Brass Corp.	1,631,388	1,608,218	
	2,263,589	2,236,588	
	791,060	753,183	
	648,418	632,590	
	6,334,455	5,230,579	52,305.79
	9,479,305	9,321,967	93,219.67

Summary of Pistons Made and Sold for the First Three Quarters of the Year 1932 Piston Patent Estate

Licensee	Total Production		Net Sales		Royalties Paid
Aluminum Company of America	578,158		567,372		
	844,687		837,296		
	700,000	2,122,845	694,795	2,099,463	20,994.63
Aluminum Industries, Inc.	333,445		329,260		
	415,332		403,897		
	208,687	957,464	198,890	932,047	9,320.47
Bohn Aluminum & Brass Corporation	900,970		884,851		
	1,119,703		1,106,078		
	1,035,011	3,055,684	1,024,641	3,015,570	30,155.70
		6,135,993		6,047,080	$60,470.80

(Here follow 2 photolithographs, side folios 1337-1338—1339-1340)



PLAINTIFF'S EXHIBIT NO. 51.
(Filed January 27, 1954.)

COMD-23762

1287-1586

520A

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[fol. 1341] **PLAINTIFFS' EXHIBIT NO. 25**

Interlocutory Decree, Simmons Case

Filed January 27, 1934

IN THE UNITED STATES DISTRICT COURT, NORTHERN DISTRICT OF OHIO, EASTERN DIVISION

In Equity. No. 3510

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Plaintiffs,

vs.

THE SIMMONS MANUFACTURING CO., Defendant

INTERLOCUTORY DECREE

This cause coming on to be heard at this term of Court upon the pleadings and the petition of the Defendant, The Simmons Manufacturing Company, to be permitted to and the offer of said Defendant to consent to a decree admitting title to the patents in suit in the Plaintiff, admitting their validity and the infringement thereof by pistons like Exhibit No. B, filed with the answers to Plaintiff's interrogatories, and counsel having been heard upon these questions, it is therefore upon consideration thereof,

Ordered, Adjudged and Decreed as follows:

(1) That Letters Patent of the United States to Spillman & Mooers, No. 1,092,870, dated April 14, 1914, for Piston for Explosion Engines or Motors, is good and valid in law as to all of the claims thereof; that the inventors Edward O. Spillman and Louis P. Mooers named in said patent were the first, true, original and joint inventors of the inventions, improvements and combinations described in said claims, and that the Plaintiff, The Cleveland Trust Company, is the lawful owner of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid:

That Letters Patent of the United States to Franquist, No. 1,153,902, dated September 21, 1915, for Piston, is good and valid in law as to all of the claims thereof; that the inventor, Gustave E. Franquist, named in said patent was

the first, true and original inventor of the inventions, improvements and combinations described in said claims, and [fol. 1342] that the Plaintiff, The Cleveland Trust Company, is the lawful owner of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid;

That Letters Patent of the United States to Schmiedeknecht, No. 1,256,265, dated February 12, 1918, for Piston, is good and valid in law as to all of the claims thereof; that the inventor, Victor E. Schmiedeknecht, named in said patent was the first, true and original inventor of the inventions, improvements and combinations described in said claims, and that the Plaintiff, The Cleveland Trust Company, is the lawful owner of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid;

That Letters Patent of the United States to Mooers, No. 1,402,309, dated January 3, 1922, for Piston for Internal Combustion Motors, is good and valid in law as to all of the claims thereof; that the inventor Louis P. Mooers, named in said patent was the first, true and original inventor of the inventions, improvements and combinations described in said claims, and that the Plaintiff, The Cleveland Trust Company, is the lawful owner of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid;

That Letters Patent of the United States to Howdeshell, No. Re-16,273, dated February 23, 1926, for Piston for Engine Cylinders, is good and valid in law as to all of the claims thereof; that the inventor, Roland M. Howdeshell, named in said patent was the first, true and original inventor of the inventions, improvements and combinations described in said claims, and that the Plaintiff, The Cleveland Trust Company, is the lawful owner of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid;

That Letters Patent of the United States to Maynard, No. 1,655,968, dated January 10, 1928, for Piston, is good and valid in law as to all of the claims thereof; that the inventor Howard E. Maynard, named in said patent was the first, true and original inventor of the inventions, improvements and combinations described in said claims, and that the Plaintiffs, The Cleveland Trust Company and Chrysler

Corporation, are the lawful owners of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid;

That Letters Patent of the United States to Jardine, No. 1,763,523, dated June 10, 1930, for Piston is good and valid [fol. 1343] in law as to all of the claims thereof; that the inventor, Frank Jardine, named in said patent was the first, true and original inventor of the inventions, improvements and combinations described in said claims, and that the Plaintiff, The Cleveland Trust Company, is the lawful owner of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid;

That Letters Patent of the United States to Gulick, No. 1,815,733, dated July 21, 1931, for Piston, is good and valid in law as to all of the claims thereof; that the inventor, Edward J. Gulick, named in said patent was the first, true and original inventor of the inventions, improvements and combinations described in said claims, and that the Plaintiff, The Cleveland Trust Company, is the lawful owner of the entire right, title and interest in and to said inventions, and in and to the Letters Patent therefor as aforesaid.

(2) That the Defendant, The Simmons Manufacturing Company, has infringed upon said Letters Patent to Spillman & Mooers, No. 1,092,870, Franquist, No. 1,153,902, Schmiedeknecht, No. 1,256,265, Mooers, No. 1,402,309, Howdeshell, No. Re: 16,273, Maynard, No. 1,655,968, Jardine, No. 1,763,523 and Gulick, No. 1,815,733, within the Northern District of Ohio, Eastern Division, and elsewhere in the United States, by the sale of pistons employing or embodying the inventions set forth in each of said patents, as illustrated by Exhibit B; and the Defendant, The Simmons Manufacturing Company, has contributed to the infringement of each of said patents within the Northern District of Ohio, Eastern Division, and elsewhere in the United States.

(3) That Plaintiff do recover from Defendant, The Simmons Manufacturing Company, all profits, gains and advantages which the Defendant has, or shall have, derived, received or made by reason of said infringement, and that Plaintiff do recover from said Defendant any and all dam-

ages which the Plaintiff has sustained, or shall sustain by reason of said infringement by said Defendant.

(4) That this cause be, and the same is hereby referred to William B. Woods, Esq., a Master, to ascertain the amount of such gains and profits and the amount of damages sustained by the said Plaintiff by reason of such infringement; that the Defendant file its account with said Master in accordance with the Rules of Equity of the Su- [fol. 1344] preme Court of the United States relevant thereto; that on such accounting the Plaintiff shall have the right to cause an examination of the officers, servants, agents and employees of said Defendant, orally or otherwise, and also to cause the production of the Defendant's books, vouchers, accounts, bills of lading, shop orders and all documents relating to the pistons sold by Defendant, and that said Defendant, through its representatives, attend for such purpose before the Master from time to time as the said Master shall direct, and that all testimony and exhibits offered and used in this cause on behalf of either party may be referred to and used in such accounting.

That Defendant was duly notified under Section 4900 of the Revised Statutes of the United States of its infringement of said patents prior to the sale of any of the alleged infringing pistons by the Defendant, and that the Defendant continued to infringe notwithstanding said notice.

(5) That an injunction be issued out of and under the seal of this Court, directed to the Defendant, The Simmons Manufacturing Company, its officers, servants, agents, employees, workmen and all their privies, and each and every one of them, enjoining and restraining them during the remainder of the respective terms of said Letters Patent, all but Spillman & Mooers, No. 1,092,870, from directly or indirectly constructing or causing to be constructed and/or using and/or selling or causing to be used or sold or advertising for sale, pistons employing or embodying any of the inventions set forth in any of said patents, or apparatus, article or device to be used, or capable only of use, in a combination infringing any of said patents, and from infringing and contributing to infringement upon or violating any of said Letters Patent in any way whatsoever.

(6) That Plaintiff recover from the Defendant the Plaintiff's full cost in this suit to date and on any matter of ac-

counting herein against this Defendant to be taxed and to have execution therefor.

Entered this 25th day of September, 1931.

Jones, United States District Judge.

We consent to the entry of the above decree.

E. L. Hyde, Counsel for Defendant, The Simmons Manufacturing Company, Wm. C. McCoy, Counsel for Plaintiff.

[fol. 1345] **PLAINTIFFS' EXHIBIT NO. 26**

Conveyance, Declaration of Trust and Agreement between L. P. Mooers and George B. Pitts and The Cleveland Trust Company Dated March 7, 1922

Filed January 27, 1934

This Conveyance, Declaration of Trust and Agreement, entered into at Cleveland, Ohio, as of the 7th day of March, 1922, by and between L. P. Mooers and George B. Pitts, of Cleveland, Ohio, First Parties, and The Cleveland Trust Company, a corporation of Ohio, Second Party.

Witnesseth, that

WHEREAS, the First Parties now own, control or hold the entire right, title and interest in, to and under certain Letters Patent of the United States for inventions or improvements relating and pertaining to and for use in or in connection with pistons for explosion engines or motors, a list of which marked "Inventions" is hereto attached and made part hereof; and

WHEREAS, said First Parties are desirous of assigning, transferring and conveying the "Property" embracing said "Inventions" hereinafter more fully described, in trust, for the uses and purposes hereinafter set forth, and are desirous of appointing and constituting the Second Party Trustee hereunder, with the respective powers, duties and discretions hereinafter set forth:

NOW, THEREFORE, in consideration of the premises and of the covenants and agreements of the parties hereto, respectively, said parties have agreed and do hereby agree as follows, that

A. For the purposes of this agreement, wherever hereinafter used, the terms:

(1) "Property" shall mean and include (a) Each and all of the Letters Patent; (b) each and all of the applications for Letters Patent; (c) each and all of the inventions and improvements; (d) each and all of the licenses, and (e) all property, rights, money and proceeds of any, and every nature whatsoever, which may be acquired, held, controlled, collected or received by said Trustee in connection with this trust and subject to the terms and provisions hereinafter set forth.

[fol. 1346] (2) "Grantors" shall mean and include the First Parties hereto.

B. For the purposes and objects expressed herein, and in order that the entire control, management and disposition of the "Property" may be vested in trust for the use and benefit of such persons or corporations as may from time to time be the beneficiaries hereunder, the Grantors hereby constitute and appoint the Second Party Trustee hereunder, with all the powers, duties and discretions as hereinafter set forth with reference to the "Property" and the management, control and disposition thereof.

C. Said First Parties, the Grantors, covenant and agree, that

(1) For the joint and several considerations hereinafter set forth, they will and hereby do sell, assign, transfer and set over to said The Cleveland Trust Company, Trustee, and its successors in trust, the entire right, title and interest owned, held or controlled by them in, to and under each and all of the inventions or improvements embraced by said exhibit "Inventions" hereto attached, and in, to and under each and all of the Letters Patent of the United States and all other countries which have been or may be granted therefor, subject, however, to a license heretofore granted under certain of said Letters Patent to Nordyke & Marmon Company, of Indianapolis, Indiana, as of the date of April 23, 1920, and which license is hereby assigned and conveyed to this Trustee; in trust, however, for the uses and purposes, and subject to the terms, provisions and conditions hereinafter stated.

(2) At the time of the execution of this instrument, said First Parties own, control or hold the entire right, title and interest in, to and under each and all of said inventions or improvements enumerated and specified in said exhibit "Inventions" and the Letters Patent of the United States which have been granted therefor, subject to said license to Nordyke & Marmon Company, and that such interests and rights have not been encumbered; that they are free to transfer the same and that they have not entered into or executed and will not enter into or execute any assignment or agreement in conflict herewith.

(3) They and their heirs and legal representatives, without further compensation, will promptly execute and deliver [fol. 1347] any further paper, assignments or instruments, and do all other acts which, in the opinion of counsel for said Trustee shall be necessary or convenient to secure to and vest in said Trustee the full and complete legal title to the "Property" aforesaid, or any of it.

D. Subject to the conditions and provisions hereinafter set forth, the Trustee shall be and it hereby is authorized and empowered as follows:

(1) To hold the title to the "Property," to determine upon and in its own name to institute and conduct suits, actions or proceedings at law or in equity relative to this trust, or in any way affecting the "Property," or any part of the same, including suits or proceedings to restrain or enjoin infringement of or to recover incomes or proceeds arising out of the "Property," and damages and profits of any and every nature whatsoever, including those arising from infringements of the Letters Patent, or any of them, embraced by this trust; to settle suits, actions or proceedings, at law or in equity, having to do with said "Property," or any of it, or with this trust, and to compromise or refer to arbitration any claims in favor of or against said trust; and likewise to defend actions or suits affecting said "Property" or this trust.

(2) To manage, develop and promote the "Property" and the interests of this trust, to endeavor to induce the use of said "Inventions or Improvements," and to endeavor to prevent the infringement of said "Letters Patent," or any of them.

(3) To grant, execute and deliver licenses relating and pertaining to said "Property," or any of it, without covenants of warranty, however, on the part of the Trustee, and to change or modify the terms, provisions and conditions thereof from time to time as it may deem to be for the best interest of the trust.

(4) To collect, receive and receipt for all license and royalty fees under said "Property," and all sums of money at any time coming due or belonging to said trust; and to hold, account for and disburse the same.

(5) To acquire and receive the title to and licenses under inventions or improvements, applications for Letters Patent and Letters Patent which, upon their acquisition, shall be included within the term "Property" as used herein.

(6) To execute and deliver such instruments as shall be necessary to convey or assign the "Property," or any [fol. 1348] part thereof, without covenants of warranty, however, on the part of the Trustee.

(7) To determine and fix the terms and considerations upon which sales or purchases of property may be made, and to determine and fix the terms and considerations upon which licenses may be granted and executed by the Trustee with respect to the "Property," or any of it, belonging to this trust.

(8) To employ counsel, solicitors, agents and experts, when and for such purposes and periods of time as it may deem to be for the best interests of this trust.

(9) To determine finally what shall be treated as capital, what as income, and what as costs or expenses of the trust, for any and all purposes connected with or affecting this trust.

(10) To make advances or borrow money upon such terms and conditions, from time to time, for the improvement, protection or preservation of the property, or for the acquisition of additional property, whenever such may seem to it desirable or proper. For the repayment of such advances, with interest, the Trustee shall have a lien upon the trust property and for sums so borrowed may issue its promissory notes as Trustee, and secure the re-

payment thereof by mortgaging or pledging any part or all of the trust property.

(11) To exercise such other powers incidental to carrying out this trust as it shall find necessary and proper, provided, however, that the same shall not be inconsistent with the nature of the trust herein and hereby created.

E. (1) The Trustee hereby accepts said trust and agrees that, subject to and in accordance with the conditions and provisions hereinbefore and hereinafter contained, it will do all things which shall be necessary and proper, in its judgment, to protect and develop the "Property," for the benefit of the beneficiaries of this trust, who shall be trust beneficiaries only, without partnership, associate or any other relationship amongst themselves or between them and the Trustee; and that it will perform the specific duties herein required to be performed by it in accordance with the intentions herein expressed.

(2) It shall be the policy of the Trustee in the conduct of the trust to endeavor to induce or require all who use the patented inventions or improvements belonging to this [fol. 1349] trust to recognize the Letters Patent relating thereto.

(3) The Trustee shall employ and keep competent representatives, for the purpose of dealing with all licenses embraced by this agreement, determining the amounts due thereon and collecting and receiving the royalties or income which shall be payable thereunder.

(4) The Trustee shall use its best endeavors regularly to collect all royalties and incomes which shall become due and payable under the licenses granted by it in connection with the "Property"; and shall take proper steps and proceedings and use its best endeavors to collect all sums which shall belong to this trust. And said Trustee shall keep all moneys in its hands as such Trustee, separate and apart from the assets of its Banking Department, but allowing interest thereon at the rate and subject to such rules as may from time to time be in force and effect in its Savings Department.

(5) The Trustee shall keep just and true books of account showing all collections and expenditures of any and

every nature whatsoever made by it, and of the "Property" and rights of any and every nature whatsoever, received or acquired by it under the terms of this agreement, said books to be open at all reasonable times for inspection by the beneficiaries hereunder, or their duly authorized representatives; and shall furnish quarterly statements therefrom to the beneficiaries, and each of them hereunder. The fiscal accounting period hereunder shall be from January 1 to December 31, inclusive, of each year during the continuance of this trust.

(6) Quarterly, on the fifteenth day of February, May, August and November of each year during the continuance of this trust, the Trustee shall distribute and pay over to the beneficiaries entitled hereunder pro rata, in accordance with their respective shares as registered on the books of the Trustee, the balance of all revenues, moneys, proceeds of sale or disposition, and license fees or royalties collected by it from said "Property," up to the first day of each said calendar month, respectively, after the deducting therefrom

(1) The reasonable expenses of management and development of the "Property," including all taxes and compensation to the Trustee, and the payment of loans and advances and interest thereon made by or to the Trustee in the interest of this trust;

[fol. 1350] (2) Such sums of money as may be required in the acquisition of inventions and improvements, applications for Letters Patent, and Letters Patent, as hereinafter provided; and

(3) Such fund or funds as may from time to time hereafter be set aside in reserve, as hereinafter provided.

Furthermore, out of the income of the trust, the Trustee may set aside an allowance for depreciation and/or depletion of the patents, patent rights and other properties embraced by the trust and which shall be subject to depreciation and/or depletion. The Trustee, in determining the amount of such an allowance, shall take into consideration the measure of the depreciation and/or depletion, if any, then allowable as a deduction from the income of the trust, in accordance with the income tax laws of the United States, but the Trustee shall not be bound to adopt such

measure as the appropriate measure of the depreciation for which it shall set aside an allowance. The Trustee in its absolute discretion, may either accumulate the fund resulting from the aforesaid allowances for depreciation and/or depletion throughout the life of the trust, or may employ it in connection with the Reserve Fund hereinafter provided for, or may from time to time distribute to the beneficiaries any part or all of the funds so accumulated, thereby reducing to such an extent the "Property." Any such distribution of allowances shall be made to the holders of the certificates of interest in this trust as they shall then appear on the records of the Trustee, and shall be made in proportion to the respective number of shares in said beneficial interest so appearing to be held by them. In any event, upon final distribution of this trust, as provided for in Article F (15) hereof, the entire amount of such accumulations then on hand and of said Reserve Fund, hereinafter provided for, then on hand, shall be distributed in the same manner as is provided for in the final distribution of other assets of the trust.

F. (1) The beneficial interest under this trust shall be represented by seven thousand (7,000) shares, evidenced by Trustee's Certificates of Interest, which said Certificates of Interest shall be in the form of the certificate hereto annexed and marked "Certificate of Interest," and shall be issued as follows:

Forthwith, after the execution of this agreement, the Trustee shall issue and deliver one (1) Certificate of Interest, in the form of the certificate hereto annexed and [fol. 1351] marked "Certificate of Interest," which shall be for three thousand (3,000) shares, and be issued and delivered to L. P. Mooers.

The remaining four thousand (4,000) shares or any part thereof may be issued, during the continuance of this agreement, by the Trustee, at such prices or for such property or property rights and upon such terms, conditions and provisions, including series denominations therefor, as said Trustee may deem to be for the best interests of the beneficiaries hereunder.

Such certificates and all like certificates issued by the Trustee hereunder, and the beneficial interest represented thereby, shall be transferable, in whole or in part, at all times, but subject to the terms and conditions of this agree-

ment, and subject to such regulations as to transfer as the Trustee may prescribe, with the right in the transferee to receive from the Trustee a Certificate or Certificates of Interest, for the number of shares transferred to it or him; and the registered holder of any Certificate of Interest may be treated by the Trustee as the absolute owner thereof, and of all the rights of the original transferer (to the extent of the number of shares transferred), in the undivided interest in the "Property" represented thereby.

The Trustee shall have power to adopt appropriate rules and regulations in regard to the transfer of Certificates of Interest, and for registering such transfers, and from time to time to change such rules and regulations as occasion may require.

(2) No debt or liability shall be incurred by the Trustee, except such as may be incidental to the management and development of said "Property," and the Trustee shall have no power to bind the beneficiaries hereunder, or any of them, personally; and in every written contract which the Trustee shall authorize, enter into or make, reference shall be made to this Declaration of Trust; and each person or corporation, contracting or dealing with the Trustee, shall look to the funds and "Property" of the trust for payment under such contract or for the payment of any debt, judgment or decree, or of any money that may otherwise become due and payable; and neither the Trustee, nor any beneficiary hereunder, shall be personally liable therefor.

(3) The Trustee may from time to time, as it shall deem expedient, select, retain, employ and discharge such representatives, agents and counsel and such experts as it may consider are best fitted to serve the trust. And the Trustee [fol. 1352] may thereupon act, through and on the advice of the person or persons so selected, retained and employed.

(4) The Trustee shall not be required to bring any suit or defend any suit with reference to the "Property" or to do any act or thing, under the terms of this instrument, which, in its judgment, may involve it in any liability unless and until indemnified to its satisfaction against any such liability and said Trustee shall be entitled to indemnity out of the "Property," as well as any funds held by it

hereunder, including the Reserve Fund provided for in Article F (7) hereof, for any liability, loss, cost, damage or expense, which it may suffer or sustain in performing any of the terms and conditions of this agreement.

(5) Should the Trustee at any time during the continuance of this trust determine that it is for the best interest of this trust to acquire and receive inventions or improvements, applications for Letters Patent, or Letters Patent, for the purpose of including the same under this trust, it shall proceed to acquire and receive such property upon such terms and considerations as it shall deem appropriate.

(6) Should the Trustee determine that it is for the best interests of the trust to sell or otherwise dispose of the "Property" or any of it at any time, it shall designate, in writing, to the beneficiaries, the terms and considerations for the same, which in its opinion are adequate and for the best interests of the trust, and shall proceed to consummate such sale or disposition in conformity therewith, and the proceeds thereof shall become a part of the "Property" hereunder.

(7) The Trustee, fro. the moneys in its hands, may set aside a Reserve Fund, sufficient, in its judgment, to defray from time to time the expense of developing, promoting and protecting the "Property" and the cost of any litigation and proceedings connected with or incidental thereto, and to indemnify the Trustee against personal liability or loss, growing out of any action taken by said Trustee hereunder, but such fund shall not at any time exceed the sum of Seven Thousand Dollars ($7,000.00), unless contingencies arise which, in the opinion of the Trustee, justify the reservation of a larger sum in the best interests of the trust, whereupon, at its discretion, the Trustee may increase said Reserve Fund to Twenty-five Thousand Dollars ($25,000.00), for such period of time as it may deem to be expedient. Such Fund shall, so far as practicable, be placed at interest, [fol. 1353] as provided for in Article E (4) hereof, and all income derived therefrom shall become a part of the "Property."

(8) The Trustee and any of its successors hereafter appointed may at any time resign the trust hereby created by giving not less than thirty (30) days' notice, in writing, to

each of the beneficiaries hereunder by mail, to their addresses, respectively, as appear upon the records of the Trustee. In case of a vacancy caused by the resignation of the Trustee, or in case of the disability of the Trustee for any reason to perform the duties hereunder, a successor or successors to the Trustee shall be chosen as follows: Within ten (10) days from the date of such resignation or notice of such determination of disability, the Trustee shall make application to a Judge of the United States District Court of the Northern District of Ohio for the appointment by him of a successor Trustee or Trustees, and such Judge shall be and is hereby authorized and empowered to name and appoint a successor Trustee or Trustees to act hereunder; provided that should no Federal Judge for such District make the appointment, or there be no Federal Judge in the District, the Trustee shall make application to a Judge of the Common Pleas Court of Cuyahoga County, Ohio, who shall be and hereby is authorized and empowered to make such appointment.

Upon such appointment being made in either manner above prescribed, the successor Trustee or Trustees so appointed shall, upon written acceptance of the trust, become immediately vested with all the rights, power and trusts, and shall assume all the duties of The Cleveland Trust Company as Trustee hereunder, with the same effect as if originally named as such Trustee; and said The Cleveland Trust Company, or the party then occupying the position of Trustee, shall, upon demand of such successor Trustee or Trustees, or any one of them, account to such successor, and immediately execute all such assignments, conveyances or other instruments as shall be necessary and proper fully to vest the successor Trustee or Trustees with all the right, title and interest in, to and under the "Property," including all sums of money which may then belong to said trust; and upon such accounting and conveyance and the delivery of such "Property," the Trustee, who has so resigned, or who has been removed, shall be from thenceforward relieved and discharged from responsibility hereunder.

[fol. 1354] (9) The Trustee may advise with counsel as to the interpretation of this instrument and as to any matter relating to the trust herein set forth, and shall be fully protected in any action or omission taken or suffered by it in good faith on the advice of such counsel, and it shall be

protected in acting upon any notice, resolution, vote, request, consent, certificate, affidavit, voucher, bond or other paper or document, believed by it to be genuine and to be passed or signed by the proper party. Should the Trustee, in the performance of any of its duties herein and without affecting in any manner the irrevocable nature of this trust, deem it advisable to secure the assent or approval of the Certificate holders hereunder, it may do so by requiring their consent, in writing, to any course or plan of action, or any act or fact done or to be done, and the decision of a majority in interest of the Certificate holders shall be final and binding on all of them, and complete protection and authority to the Trustee. Nothing herein contained, however, shall be deemed to require the Trustee to secure or be bound by the assent or approval of the Certificate holders, or any of them, to any such course or plan of action, or to any act or fact done or to be done.

(10) Should any suit or suits be brought against the Trustee by reason of or because of anything done by it under this agreement and in pursuance thereof, and not resulting from its own bad faith or willful misconduct, or that of its agents, servants or representatives, in connection with or growing out of the terms and provisions hereof, the Trustee is authorized to defend such suits, and for that purpose to employ funds of this trust sufficient therefor, and to fully indemnify it in connection therewith.

(11) The Trustee shall not be liable hereunder for any loss arising out of the execution of this trust so long as it shall act in good faith; and said Trustee shall be liable hereunder only for the bad faith or willful misconduct of itself or its own agents, servants or representatives. In no event shall it be liable for any act or default of any counsel, solicitor, agent or expert, selected, retained or employed pursuant to the provisions of Article D (8), F (3) and F (9) hereof, provided reasonable care shall have been exercised by it in their selection. The Trustee shall not be required to give bond to secure the faithful performance of this trust by it, but in case of the appointment of a successor Trustee or Trustees, not a trust company, the said appointing Judge [fol. 1355] may, in his discretion, require such security for the performance of the duties of such successor Trustee or Trustees as in his judgment is just and proper.

(12) The Trustee shall receive reasonable compensation from time to time all of its services performed under this agreement.

(13) The death of a beneficiary holding a Certificate of Interest hereunder shall not operate to determine or in any manner affect this trust, but his Certificate of Interest shall pass to his executor, administrator, heirs, or legal representatives, and vest in them the ownership of such Certificate or Certificates of Interest, together with the interest in this trust represented thereby, in the same manner as it is held by the beneficiary.

(14) Whenever the Trustee is required under this agreement to communicate with or give notice to the beneficiaries hereunder, it may do so by written communication or notice mailed contemporaneously to each of the beneficiaries entitled to receive the same, addressed to the last known addresses, respectively, of such beneficiaries, as shown by the records of the Trustee.

(15) This trust shall continue until the expiration of all the Letters Patent which may hereafter become a part of the "Property" of said trust, or until all of the "Property" has been sold or disposed of, as hereinbefore provided, and until the Trustee has fully accounted for, distributed and paid over all moneys and "Property" received, or in any manner held by it hereunder.

(16) In the interpretation and construction of this instrument, the laws of the State of Ohio shall govern.

In Witness Whereof, said L. P. Mooers and George B. Pitts have executed and delivered this instrument, and, as evidencing its acceptance of the trusts and confidences herein imposed upon it, said The Cleveland Trust Company has caused this instrument to be executed and its corporate seal to be affixed hereto by executive officers, thereunto duly authorized, the execution and delivery being at Cleveland, Ohio.

L. P. Mooers, George B. Pitts. The Cleveland Trust Company, R. A. Malm, Vice President; A. J. Perfler, Assistant Trust Officer.

[fol. 1356] "Inventions"

Patentee	Number	Date
Spillman & Mooers	1092,870	April 14, 1914
H. C. Marmon	1293,846	Feb. 11, 1919
L. P. Mooers	1347,819	July 27, 1920
L. P. Mooers	1402,308	Jan. 3, 1922
L. P. Mooers	1402,309	Jan. 3, 1922

and the undivided one-half of any right, title and interest now owned or held by said Louis P. Mooers in Letters Patent of countries foreign to the United States corresponding to said Letters Patent of the United States No. 1092,870.

This list forms a part of the Conveyance, Declaration of Trust and Agreement entered into as of the 7th day of March, 1922, between Louis P. Mooers and George B. Pitts and The Cleveland Trust Company.

Certificate of Interest

No. —. — Shares

This is to Certify, that —— ——, Address ——, ——, is owner of — shares of undivided interest in the net profits and avails, when the same may be distributable, from certain "Property" comprising certain Inventions or Improvements, Applications for Letters Patent which have been or may be filed therefor and Letters Patent which may be granted thereon, and rights thereunder, more particularly described in a certain Conveyance, Declaration of Trust and Agreement entered into as of the 7th day of March, 1922, by and between L. P. Mooers and George B. Pitts, therein referred to as "Grantors," and The Cleveland Trust Company therein referred to as "Trustee," a copy of which is on file at the principal office of said The Cleveland Trust Company, in the City of Cleveland, Ohio, and open to the inspection of any holder of this Certificate, and that the legal title to said property is held by said The Cleveland Trust Company for the use and benefit of the various registered owners of interests therein, subject to and in accordance with the provisions of the aforementioned Conveyance, Declaration of Trust and Agreement so on file, reference to which is hereby made for a description of the nature and extent of the "Property," the rights and privileges of the holders of said Certificates of Interest,

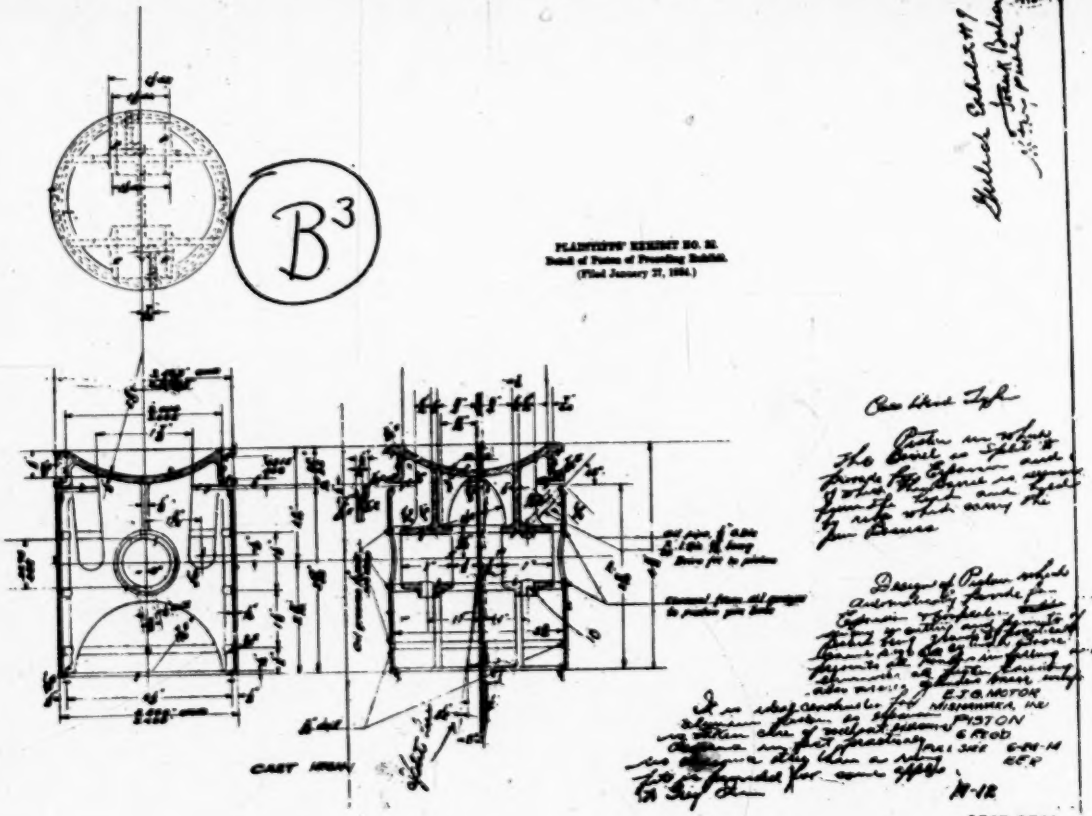
and the terms and conditions upon which said Certificates [fols. 1357-1362] are issued. The holder of this certificate, by acceptance hereof expressly ratifies all of the terms and conditions of said Conveyance, Declaration of Trust and Agreement. The Cleveland Trust Company assumes no responsibility as to the validity of the title to the "Property" purported to be conveyed to it in trust, pursuant to the aforementioned Conveyance, Declaration of Trust and Agreement. The registered holder of this Certificate may be treated as the actual owner of this Certificate and the interest represented thereby for all purposes whatsoever.

This Certificate and the interest evidenced thereby may be transfered upon surrender thereof to the Trustee, duly endorsed, and subject to such rules and regulations governing transfers as the Trustee may establish.

The Cleveland Trust Company, by —— ——, Vice President. —— ——, Assistant Trust Officer.

Cleveland, Ohio, —— —, 19—.

(Here follows 1 photolithograph, side folio 1363-1364)



PLAINTIFFS' EXHIBIT NO. 31.
Detail of Pattern of Preceding Exhibit.
(Filed January 27, 1894.)

1363-1364

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[fols. 1365-1378] **PLAINTIFFS' EXHIBIT NO. 38a.**

Supplemental Contract between The Cleveland Trust Company and Aluminum Company of America dated April 26, 1924

[Also offered as Defendants' Exhibit 4-T]

(Filed January 27, 1934)

This Agreement made and entered into this 26th day of April, 1924, by and between The Cleveland Trust Company, of Cleveland. Ohio, hereinafter sometimes called the licensor, and Aluminum Company of America, a Pennsylvania corporation of Pittsburgh, Pa., hereinafter sometimes called the licensee.

Witnesseth:

Whereas, the parties hereto have of even date entered into a contract hereinafter sometimes called the license agreement, a copy of which is attached hereto and marked Exhibit "D," and to which this contract is a supplement.

Now, Therefore, in consideration of the premises and of the covenants and agreements of the parties hereto made herein and in the license agreement, a copy of which is attached hereto and marked Exhibit "D," said parties have covenanted and agreed, and do hereby covenant and agree with each other further as follows:

1. In case the royalty per piston payable by any sub-licensee to the licensee, under the license agreement, is established at less than one cent ($.01) per piston by Board of Arbitration or others acting beyond the control of the licensee, the licensor shall accept the royalty so set at less than one cent ($.01) per piston as a royalty in full to be paid by the licensee hereunder for all pistons made and/or sold by such sub-licensee.

2. The licensee shall make vigilant effort to collect all royalties accruing from the sub-licensees under their sub-licenses, respectively. If the licensee is unable, after the exercise of due diligence, to collect royalties due from any sub-licensee, the licensee will be relieved from paying to the licensor the licensor's proportion of such uncollectable

royalties, and if the licensee has advanced to the licensor any royalties which prove to be uncollectable, the licensor will refund to or credit the licensee with the amount of such uncollectable portion so advanced. After the licensee has notified the licensor that any royalties are uncollectable, the [fols. 1379-1380] licensee will, upon demand in writing from the licensor, assign the licensor's proportion of such uncollectable account to the licensor.

3. In case the license agreement is cancelled for any reason whatsoever other than because of failure of the licensee to carry out its obligations or any of them to the licensor thereunder, the licensor agrees to reassign to the licensee all patents, patent applications or other patent rights which have been assigned by the licensee to the licensor under said license agreement (Exhibit "D" attached hereto), subject, however, to any and all licenses and sub-licenses which have been granted either by the licensor or the licensee or which the licensor is under contract to grant with respect to such patents, patent applications or other patent rights to (1) Walker M. Levett Company and W. M. Levett Corporation of New York; (2) The National Piston Company, Incorporated, of New York and (3) The Kant-Skore Piston Company, of Cincinnati, Ohio, copies of which contracts are hereto attached and marked Exhibits E, F and G, respectively.

In Witness Whereof the parties hereto have caused this instrument to be executed in duplicate by their respective officers hereunto duly authorized as of this 26th day of April, A. D. 1924.

The Cleveland Trust Company, By A. R. Horr, Vice President.

Attest: A. J. Perfler, Ass't. Tr. Officer.

Aluminum Company of America, By W. P. King, Vice President.

Attest: G. R. Gibbons, Secretary.

[fol. 1381] **PLAINTIFFS' EXHIBIT NO. 38b**

License Agreement between The Cleveland Trust Company and Aluminum Company of America

[Also offered as Defendants' Exhibit 4-S]

(Filed January 27, 1934)

License Agreement

This license agreement made and entered into by and between The Cleveland Trust Company, of Cleveland Ohio, hereinafter called sometimes the licensor, and Aluminum Company of America, a Pennsylvania corporation, hereinafter sometimes called the licensee, witnesseth:—

Whereas, the Licensor owns the entire right, title and interest in and to the following Letters Patent and applications for Letters Patent in the United States—

Number	Patentee	Date
1,092,870	Spillman & Mooers	April 14, 1914
1,279,184	J. G. Vincent	Sept. 17, 1918
1,293,846	H. C. Marmon	Feb. 11, 1919
1,327,147	Harold D. Church	Jan. 6, 1920
1,347,819	L. P. Mooers	July 27, 1920
1,402,308	L. P. Mooers	Jan. 3, 1922
1,402,309	L. P. Mooers	Jan. 3, 1922
Ser. No. 204,661	E. J. Gulick, Filed	Nov. 30, 1917, and

has arranged to acquire the entire right, title and interest in and to Letters Patent 1,153,902 dated September 21, 1915, to Gustave E. Franquist and,

Whereas, the licensor may acquire other United States patents, patent applications and patent rights relating to pistons, and/or the processes and/or the machines for making the same, during the life of this agreement; and

Whereas, the said licensee is desirous of acquiring a license to make, use and sell the inventions included in the said patents and applications acquired and to be acquired by the licensor for the full term for which said patents are or shall be granted.

Now, Therefore, in consideration of the premises and of the covenants and agreements of the parties hereto, respectively as hereinafter set forth, said parties have covenanted

and agreed, and do hereby covenant and agree with each other as follows:

[fol. 1382]

I

The Licensor grants the licensee the exclusive right to make, use and sell and the exclusive right to grant to others the right to make, use and sell, the inventions and devices embodying the inventions covered by the patents and applications above named or to be covered by any continuations and divisions, renewals or reissues of the same, for the full term of each of said patents, with the exception that the licensor reserves to itself the right to make, use and sell and the right to grant to others the right to make, use and sell pistons made entirely of cast iron or steel, and it is specifically agreed that the licensor neither grants nor agrees to grant to the licensee in this agreement the exclusive right to make use or sell pistons made entirely of cast iron or steel, it being understood that the licensee has hereunder a non-exclusive license to make, use and sell, and the right to grant to others the right to make, use and sell cast iron or steel pistons embodying the inventions covered by the patents and applications above named, or to be covered by any continuations and divisions, renewals or reissues of the same, for the full term of each said patents. This license and agreement will be automatically extended to cover any other and further patents or applications or other rights under patents which the licensor may acquire relating to pistons and/or processes and/or machines for making the same, unless excluded therefrom by the licensee as hereinafter provided, and the licensor agrees to execute any further instruments and perform any further acts, if any are required, to consummate the granting of licenses to the licensee or parties indicated by the licensee under this agreement. This license s subject to a license granted by The Cleveland Trust Company to Nordyke & Marmon Company, April 23, 1920, a copy of which is attached hereto marked Exhibit A.

II

The Licensor releases and discharges the Licensee, all of its controlled and subsidiary companies, and Aluminum Manufacturers, Inc., and The Aluminum Castings Company, all sub-licensees under this agreement and all vendees and/or users of pistons, the castings for which were heretofore

acquired from the Licensee or either of the said companies, or said sub-licensees, from any and all claims whatsoever for damages or profits by reason of any alleged past in-
[fol. 1383] fringement of any of the patents aforesaid now owned by the Licensor and arising out of the manufacture, use and sale of such pistons; and from any claim or claims for past damages or profits which shall be acquired by the Licensor in the future, during the continuance of this agreement, and theretofore arising out of the manufacture, use and sale of such pistons; and agrees not to institute or to aid or abet the institution of any suit against the Licensee or any of its controlled and subsidiary companies, or Aluminum Manufactures, Inc., or The Aluminum Castings Company, or sub-licensees, or the vendees or users of pistons, the castings for which were heretofore acquired from the Licensee or either of the said companies, or said sub-licensees, for any alleged past infringement of any patents relating to the subjects covered by the patents or applications named herein or for damages and profits because of alleged past infringement thereof and heretofore arising out of the manufacture, use and sale of such pistons.

III

1. (a) The Licensor shall institute and prosecute to a conclusion with due diligence suit or suits against any or all infringers of the patents included within the terms of this agreement necessary reasonably to protect the interests of the licensee acquired hereunder, provided that the licensor be indemnified to its satisfaction by the licensee for any costs or expenses which the licensor may suffer or sustain in connection with or growing out of any such suit.

(b) The licensor shall defend any suit or suits, so far as such defence shall be necessary reasonably to protect the interests of the licensee acquired hereunder, brought because of the alleged infringement of any letters patent covering the design of pistons made, sold or used under this agreement and for which royalties are paid under this agreement, provided that the licensor be indemnified to its satisfaction by the licensee for any costs or expenses which the licensor may suffer or sustain in connection with or growing out of any such defense.

2. Should the licensor bring and prosecute or defend as above provided such infringement suit or suits at its own expense, all profits or damages recovered in said suit or suits shall be the absolute property of the licensor.

[fol. 1384] 3. In the event of the failure of the licensor promptly to institute and vigorously prosecute or to defend such suit or suits as may be necessary reasonably to protect the interests of the licensee hereunder, then and in that event, the licensee having reasonably indemnified the licensor, may in the name of the licensor or the names of the licensor and licensee jointly institute or adopt and diligently prosecute or defend at the licensee's expense such suit or suits as may be required reasonably to protect its interests. The licensor at any time shall have the right to join in the prosecution or defense of such suit or suits with its own counsel and at its own expense.

4. Should the licensee bring or prosecute or defend as above provided any such infringement suit or suits or should the licensee furnish indemnification to the licensor in connection with suits brought or prosecuted or defended by the licensor and pay any sum on account of such indemnification, it shall have the right to apply all royalties payable by it on the reasonable costs and expenses of such suit or suits, including attorney's fees, or on said sum paid on account of indemnification and shall apply the sum, if any, recovered in any such suit, first, to the reimbursement of it for said reasonable expenses and costs, including attorney's fees, and not theretofore reimbursed to it out of royalties or sums paid on account of indemnification, and second, to the payment to the licensor of all sums theretofore deducted by the licensee from royalties and applied to the said reasonable costs and expenses, including attorney's fees, of such suit or payments of indemnification and the balance shall be the absolute property of the licensee.

IV

The Licensee agrees that it will within the months of January, April, July and October of each year from and after the execution hereof, furnish to the licensor, its successors or assigns in interest, a written statement under oath which shall show:

(a) the number of pistons made by or for it, imported by it and sold or otherwise disposed of by it during the pre-

ceding three calendar months which contain or which to the licensee's knowledge are to be modified or fabricated by the licensee's vendees to contain and embody any invention covered by any of the claims of any of the letters patent and application recited herein, or in the future acquired [fol. 1385] by the licensor and included herein. This report shall be made whether the licensee makes or sells any pistons during the preceding royalty period, or not, and

(b) the number of such pistons sold by the licensee and for which the vendee has been subsequently credited.

The first report shall include the pistons contemplated in this paragraph between January 1, 1924 and April 1, 1924.

V

The Licensee will pay the licensor royalty of one cent ($.01) upon each piston sold* or otherwise disposed of by it during the life of this agreement embodying in its construction any invention covered by one or more of the claims of the letters patent and application named herein or in the future acquired by the licensor and added hereto, and upon each piston made and sold by the licensee with the intention or the knowledge of the licensee that it shall be modified or fabricated by the licensee's vendee in such a way as to embody in its construction any invention covered by one or more of the claims in the letters patent or applications covered hereby.

It is understood that no royalties will be payable or collectible upon the licensed pistons which have been sold and for which the vendee thereof has been subsequently credited, and that if any royalties have been paid upon the licensed pistons which are sold, and for which the vendee has been subsequently credited, the licensee shall have credit therefor upon the next due payment.

VI

Within thirty (30) days after it shall have furnished, in January, April, July and October of each year, state-

* Sold in this contract means and includes only licensed pistons which are both contracted for and delivered, during the life of this agreement.

ments specified in the paragraph herein numbered (IV), the licensee shall and will pay to the licensor, its successors or the assigns of its interest in said letters patent, the royalties upon the pistons covered by said reports, at the rate prescribed.

[fol. 1386]

VII

The licensee agrees that it will keep accurate books of account, giving full particulars of the licensee's business in the inventions covered by this agreement and will in the event of controversy admit the licensor or its duly accredited agent at all reasonable times to inspect the same.

VIII

In the event that the combination set forth in any of the claims of the application for letters patent and of the letters patent to be granted thereon above recited and the letters patent above recited or acquired in the future and added hereto is held by a court of final jurisdiction or by an inferior court from whose decree no appeal is taken or the appeal is denied or dismissed, to be an infringement of any other patent in any patent suit brought in the United States against the licensor, the licensee, any other of the licensor's Licensees, any sub-licensees or any of its or their vendees, the licensee shall have, and is hereby given, the right and option to exclude from this license any such claim or claims or the letters patent or application for letters patent containing such claim or claims, as the case may be, and to have the royalty payable hereunder reduced proportionately if any, to the reduction, caused by such judicial holdings in the value of the patents and applications comprehended by this agreement, such proportion to be determined by arbitration as hereinafter in paragraph (XX) hereof provided, or to terminate this agreement altogether by giving to the licensor notice in writing of its election so to do within six (6) months from the rendition of the judicial holding of the court of final jurisdiction or after the expiration of the time for appeal or after the appeal has been denied or dismissed.

IX

The licensor authorizes and empowers the licensee to grant sub-licenses to manufacture, make, use and/or sell

within the United States pistons which contain and embody any inventions covered by any of the claims of any of the letters patent and applications for letters patent comprehended herein; provided that each and every such sub-license so granted shall expressly refer to this license, shall be of no greater scope than this license and shall terminate therewith; and provided further that all royalties [fol. 1387] payable by the sub-licensee shall be payable directly to the Aluminum Company of America or its order and the proportion thereof due to the licensor, namely, one cent ($.01) per piston, shall be payable forthwith to the licensor by the licensee hereunder.

X

This agreement and license shall be transferable to the successors or assigns of either of the parties hereto, but in that event the successors or assigns shall be bound by the provisions of this agreement and obligated to conform thereto.

XI

The licensee will not during the life of this agreement contest, or aid others in contesting the validity of any of the letters patent included within this agreement or afterwards acquired by the licensor and included in this agreement.

XII

The licensee can have and hereby is given the right and option to exclude from this license any letters patent or application for letters patent or other patent rights which the licensor may acquire after the execution of this license provided the licensee gives the licensor notice in writing of such exclusion within ninety (90) days after notice in writing to the licensee by the licensor of the acquisition of any letters patent or applications or other patent rights, not recited in this agreement.

XIII

The licensee shall pay royalties only upon pistons both contracted for and delivered during the term of this license —pistons contracted for before or delivered after the term of the contract are free of royalties.

XIV

If either of the parties hereto neglects or refuses to keep any of its covenants herein, then the other party hereto may serve on the derelict party by registered mail a notice in writing of such default and if the derelict party shall continue such default for thirty (30) days after the serving of such notice, then the aggrieved party may at its option cancel this license by a notice in writing of such cancellation and termination, provided, however, [fol. 1388] that the foregoing remedy shall not exclude any other remedy which the aggrieved party may have at law or in equity. The waiver of any breach by either party shall not be interpreted as constituting a waiver of any further breach or breaches.

XV

The licensor hereby grants to the licensee the exclusive right to make, use and sell the inventions covered by any foreign patents or applications for foreign patents, which the licensor now owns or controls which relate to pistons with the exception that the licensor reserves to itself the right under such foreign patents to make, use and sell and the right to grant to others the right to make, use and sell pistons made entirely of cast iron or steel. The licensor agrees to release the licensee, its subsidiary and controlled companies, the Aluminum Manufactures, Inc., The Aluminum Castings Company, their vendees, and all users of their pistons, from any claim or claims for alleged infringement of foreign patents, which the licensor now has or in the future may acquire against any of them. It is specifically agreed that the licensor neither grants nor agrees to grant to the licensee in this agreement the exclusive right to make, use or sell pistons made entirely of cast iron or steel under such foreign patents. It being understood that the licensee has a non-exclusive license under, and the right to license others under such foreign patents to make, use and sell pistons embodying inventions covered by any foreign patents which the licensee now owns or controls when such pistons are made entirely of cast iron or steel. The Licensor agrees, upon demand of the licensee, to execute all instruments and perform all acts necessary to complete the licenses under this paragraph. This license and agreement will be automati-

cally extended to cover any other and further foreign patents or applications for foreign patents or other rights under foreign patents which the licensor may acquire relating to pistons and/or processes and/or machines for making the same unless excluded therefrom by the licensee as hereinafter provided, and the licensor agrees to execute any further instruments and perform any further acts, if any are required, to consummate the granting of licenses to the licensee or parties indicated by the licensee under this agreement.

[fol. 1389]

XVI

Should the inventions, for the use of which the Licensee pays royalty under this agreement, be made, sold or used generally by others, in the aluminum piston or automobile trade, not licensed under the patents included in this contract, forthwith upon the finding by arbitration as hereinafter provided that such a condition exists, the Licensee may, at its option, (a) terminate this contract on ninety (90) days notice in writing to the Licensor of its intention so to do, or (b) surrender its exclusive license granted by this contract and retain a non-exclusive right and license to continue the use of the patented inventions without the payment of any royalty therefor until such infringement ceases.

XVII

The licensee shall have the following privileges and rights:

(a) At any time within two (2) years after the date of execution of this agreement, upon ninety (90) days' notice in writing to the Licensor of its intention so to do, to cancel this agreement; and

(b) To surrender this license at the end of two (2), four (4), six (6), eight (8), ten (10) years or any other period consisting of an even number of years after the date of execution hereof by giving to the licensor notice in writing of its desire and intention so to do at least ninety (90) days prior to the date the license is to be terminated; but any such termination of this license as in this article specified shall not release the licensee or the licensor from any obligations theretofore accruing to the opposite party.

XVIII

The licensee shall use reasonable diligence in manufacturing and/or marketing pistons embodying inventions licensed hereunder, and, in the event that, during the continuance of this agreement, it should not do so, the licensor shall have the following rights, options and privileges exercisable by it forthwith upon the finding by arbitration as hereinafter provided that the licensee has not used and is not using such diligence;

[fol. 1390] (a) To cancel or terminate this agreement by giving six (6) months' notice in writing to the said licensee of its desire and intentions so to do; whereupon at the expiration of said six (6) months from the date of said notice this agreement shall be terminated.

(b) To grant an additional license or licensee under the inventions or improvements, applications for letters patent and letters patents, or any of them, then embraced by and included within the terms of this license.

XIX

Should the licensee, taking advantage of its privilege under any of the provisions of this contract, elect to terminate this contract and stand out from under the same, the licensee shall not be estopped to deny the validity of any of the patents covered or comprehended by this contract and shall not be deprived of any of the defenses or the rights of a defendant in an ordinary patent infringement suit, but, on the contrary, shall stand in the position of one who had never entered into this contract.

XX

In the event either party hereto calls for an arbitration as provided for in this contract, each party shall select an arbitrator and the two arbitrators shall select a third arbitrator. In the event that the two arbitrators fail to select a third or in the event either party fails to select its arbitrator, it is agreed that the third and/or second arbitrator may be selected by the district judge of the United States District Court, Northern District of Ohio, Eastern Division, who has then been longest in said office. The three arbitrators thus selected shall constitute the Board of Arbitration and the parties hereto shall submit

their contentions to this Board of Arbitrators at a time and in a manner determined by the arbitrators. The decision of any two arbitrators shall be final and binding on the parties hereto. Each party shall bear the expense of its arbitrator and both shall bear the expense of the third arbitrator share and share alike.

[fol. 1391]

XXI

The licensor agrees that should it at any time during the life of this agreement grant licenses under the patents, now included or in the future included in this agreement, or under the substantial and material patents now included or to be included in this agreement, at lower rates than one cent ($.01) per piston as provided for herein, or otherwise upon more favorable terms than are provided for herein, then this agreement shall, on the request of the licensee, be modified to make its terms as favorable as these upon which any subsequent license may be granted.

XXII

The licensee agrees to assign, or cause to be assigned, to the licensor all United States patents and applications for United States patents which it now owns or in the future during the life of this contract acquires or controls relating to pistons per se.*

XXIII

This agreement, in the construction of which the laws of the State of Ohio shall govern, is made by the Licensor under title conveyed by or acquired under and subject to the terms, provisions and conditions of a certain Conveyance, Declaration of Trust and Agreement entered into as of the 7th day of March, 1922, by and between Louis P. Mooers and George B. Pitts and The Cleveland Trust Company, Trustee, the Licensor herein, a copy of which is on file at the principal office of said The Cleveland Trust Company in the City of Cleveland, and open to the in-

* Pistons per se means pistons whose patentability depends upon physical, structural characteristics of the piston and not upon the character of the material in the piston or the molds, machines or the processes by which the piston is made.

spection of the Licensee, and unless terminated as hereinbefore provided, shall terminate with the date of expiration of the last Letters Patent now or hereafter embraced in said Declaration of Trust and Agreement.

In Witness Whereof, the parties have caused this instrument to be executed in duplicate by their respective [fol. 1392] officers hereunto duly authorized as of this 26th day of April, A. D., 1924.

THE CLEVELAND TRUST COMPANY,
By R. A. MALM,
Vice President.
(Corporate Seal)

Attest:
A. J. PERFLER,
Ass't. Tr. Officer.

ALUMINUM COMPANY OF AMERICA,
By W. P. KING,
Vice President.

Attest:
G. R. GIBBONS,
Secretary.

(Corporate Seal)

Approved for Execution by The C. T. Co.
R. T. S., *Counsel.*

* * * * * * *

[fol. 1393] EXHIBIT A

LICENSE AGREEMENT

This Agreement made this 23rd day of April, 1920, between The Cleveland Trust Company, a corporation of the State of Ohio, hereinafter called the Licensor, and Nordyke & Marmon Company, a corporation of the State of Indiana, hereinafter called the Licensee.

Witnesseth, that

Whereas, the Licensor owns and holds title to the following: (a) Letters Patent of the United States No. 1,092,870, patented April 14, 1914, to E. O. Spillman and L. P. Mooers, for Piston for Explosion Engines or Motors; (b) application for Letters Patent of the United States, Sr. No.

106,502 and 106,503, filed June 28, 1916, by Louis P. Mooers for Pistons for Internal Combustion Motors; and (c) also owns and has title to all claims for damages and profits arising out of past infringement by the Licensee of said Letters Patent, and

Whereas, the Licensee is desirous of acquiring a license under said Letters Patent and those which may be granted upon the aforesaid applications for Letters Patent:

Now, Therefore, for and in consideration of the premises, of the covenants and agreements of the parties hereto, respectively, as hereinafter set forth, and in further consideration of the assignment of Letters Patent of the United States No. 1,293,846, dated February 11, 1919, to Licensor, by Howard C. Marmon, the parties hereto have covenanted and agreed, and do hereby covenant and agree with each other, as follows:

[fol. 1394] A. The Licensor, on its part, does hereby:

(1) Grant to the Licensee the right and license, not exclusive, to manufacture, have manufactured for it, assemble, and use in and sell for use in Licensee's engines, mechanism and apparatus having and containing any or all of the inventions shown, described and claimed in the above recited Letters Patent and applications for Letters Patent and the Letters Patent of the United States which may be granted upon the latter, or either of them.

(2) Release and discharge the Licensee and all who have sold or used the product of the Licensee from any and all claims whatsoever for damages and profits arising by reason of infringement of said Letters Patent by Licensee's product.

B. It is understood and mutually agreed that:

(1) This license is not divisible and is not assignable by the Licensee excepting to a successor in business of the Licensee.

(2) This agreement is made by the Licensor subject to the terms, provisions and conditions of a certain Declaration of Trust and Agreement entered into, in writing, as of the date of August 4, 1917, by and between Louis P. Mooers and George B. Pitts, as Grantors, and The Cleveland Trust Company, et al., as Trustee, including Article F-2 thereof, which reads:

"2. No debt or liability shall be incurred by the Trustee, either collectively or individually, except such as may be incidental to the management and development of said 'Property' and the Trustee shall have no power to bind the beneficiaries hereunder, or any of them personally; and in every written contract which the Trustee, or either of them, shall authorize, enter into or make, reference shall be made to this Declaration of Trust; and each person or corporation contracting with the Trustees, or either of them, shall look to the funds and 'Property' of the Trust for payment under such contract or for the payment of any [fols. 1395-1396] debt, judgment or decree, or of any money that may otherwise become due and payable; and neither of the Trustees, nor any beneficiary hereunder, shall be personally liable therefor."

A copy of which Agreement is on file at the principal office of said The Cleveland Trust Company in the City of Cleveland, Ohio, and open to inspection of the Licensee.

In Testimony Whereof, said parties have hereunto set their hands and seals by their respective officers hereunto duly authorized by said The Cleveland Trust Company and said Nordyke & Marmon Company, respectively, the execution being at the places and on the dates appearing under their respective names below.

THE CLEVELAND TRUST COMPANY,
By E. L. MASON,
Vice President.

Attest:
E. B. MERRELL,
A-Secretary.

Cleveland, Ohio,
Dated: May 6th, 1920.

NORDYKE & MARMON COMPANY,
By W. C. MARMON,
President.

Attest:
H. G. SHAFER,
Secretary.

Indianapolis, Indiana. Dated April 23rd, 1920.

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[fol. 1397] **PLAINTIFFS' EXHIBIT NO. 38c**

License Agreement between Walker M. Levitt Co., W. M. Levitt Corp., Walker M. Levitt and The Cleveland Trust Company, Dated April 11, 1924

(Filed January 27, 1934.)

Agreement

This Agreement made and entered into this 11 day of April, 1924, by and between Walker M. Levett Company and W. M. Levett Corporation, both being corporations of the State of New York and Walker M. Levett, of New York City, jointly and severally, (hereinafter referred to as parties of the first part) and The Cleveland Trust Company, of Cleveland, Ohio, a corporation of the State of Ohio, (hereinafter referred to as the Trust Company).

Witnesseth:

Whereas, the Parties of the First Part own the entire right, title and interest in and to applications for Letters Patent of the United States, Serial No. 470,502, filed May 18, 1921 of Gustav R. Kelm; and

Whereas, parties of the first part desire, under certain conditions, to dispose of their interest in and to the said application for patent and in any other patents or applications for Letters Patent relating to pistons per se* which they may own wholly or in part, or subsequently acquire, and

Whereas, the Trust Company desires to obtain the entire right, title and interest in and to the said application for letters patent and the entire right, title and interest possessed by the parties of the first part, and each of them, in and to any other patents or applications relating to pistons per se now owned or subsequently acquired by the parties of the first part together with certain rights to past infringements of the said patent or patents and application or applications.

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* Pistons per se means pistons whose patentability depends upon physical, structural characteristics of the piston and not upon the character of the material in the piston or the molds, machines or the processes by which the piston is made.

Now, Therefore, in consideration of the covenants and agreements of the parties hereto, respectively as hereinafter set forth, said parties have covenanted and agreed, [fol. 1398] and do hereby covenant and agree with each other as follows:

1. The Parties of the First Part agreed to sell, assign, transfer and set over to and hereby do sell, assign, transfer and set over to The Cleveland Trust Company as trustee under a certain conveyance, Declaration of Trust and Agreement dated March 7, 1922, copy of which is attached, marked "Exhibit A"* and another copy of which is on file with The Trust Company, the entire right title and interest in and to said application for Letters Patent Serial No. 470,502 and the entire right, title and interest possessed by the Parties of the First Part, and each of them, in and to any Letters Patent or applications for Patent relating to pistons per se now owned, held, wholly or in part, on the date of the execution of this agreement or subsequently acquired; together with the right to sue and collect for all past infringements of the said patent or patents, or of any patent or patents issuing from such application or applications, and to collect damages and profits arising out of such infringement and apply the same to the benefit of The Cleveland Trust Company, as trustee.

2. The Parties of the First Part hereby agree for themselves, their respective executors and legal representatives, to execute and deliver to The Cleveland Trust Company, as trustee, any and all other papers or documents necessary or desirable more fully to convey to The Cleveland Trust Company, as trustee, the entire right, title and interest in and to the said applications, and Letters Patent when, and as, the same may be requested by The Cleveland Trust Company as trustee, and to do any and all further acts which may be desirable or necessary more effectually to secure to or vest in The Cleveland Trust Company, as trustee, its successors and assigns the entire right, title and interest in and to the said invention, Letters Patent and applications hereby sold, assigned and transferred or intended so to be.

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* PRINTER'S NOTE:

The "Exhibit A" referred to above was not attached to Exhibit 38c.

3. The Parties of the First Part hereby agree for themselves, their respective executors and legal representatives, to assign to The Cleveland Trust Company, as Trustee, without further consideration the entire right, title and [fol. 1399] interest in and to any United States Letters Patent or application relating to pistons per se which they may in the future acquire forthwith upon obtaining the same together with whatever rights they may acquire to sue and collect for past infringement thereof and to apply any damages and profits so recovered to the benefit of The Cleveland Trust Company as trustee.

4. In case the sub-license from the Aluminum Company of America to the parties of the first part, a copy of which is attached hereto, made a part hereof and marked "Exhibit B,"* is canceled or terminated for any reason whatsoever, excepting the failure of parties of the first part reasonably to comply with their obligations thereunder, and said parties of the first part forthwith applied to whomsoever then holds or controls as owner or exclusive licensee, the inventions, applications for Letters Patent and Letters Patent embraced by such sub-license, for another sub-license upon terms at least as favorable for parties of the first part as those in said sub-license "B" contained, and such owner or exclusive licenses as the case might be, fails to execute or deliver to parties of the first part such a sub-license within thirty (30) days from the date of such application by said parties of the first part, then and in that event, this agreement shall be deemed and construed henceforth to operate as such a sub-license having the terms and conditions of the sub-license, Exhibit "B," applicable for such purpose and said parties of the first part shall account thereunder directly to The Trust Company.

5. This agreement, in the construction of which the laws of the State of Ohio shall govern, is made by The Trust Company under title conveyed by or acquired under and subject to the terms, provisions and conditions of said Conveyance, Declaration of Trust and Agreement of which "Exhibit A" is a copy.

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*PRINTER'S NOTE:

The "Exhibit B" referred to above was not attached to Exhibit 38c.

[fols. 1400-1402] In Witness Whereof the parties hereto have set their hands and affixed their seals this 11th day of April, 1924.

WALKER M. LEVETT COMPANY,
W. M. LEVETT,
President.

(Corporate Seal)

ATTEST:
L. E. VALCOURT,
Secretary.

W. M. LEVETT CORPORATION,
W. M. LEVETT,
President.

(Corporate Seal)

ATTEST:
L. E. VALCOURT,
Secretary.

WALKER M. LEVETT.

A. F. HUSSEY.

THE CLEVELAND TRUST COMPANY,
By R. A. MALM,
Vice President.

(Corporate Seal)

ATTEST:
A. J. PERFLER,
Ass't. Trust Officer.

Apr 11 1924

Approved for Execution by The C. T. Co.
R. T. S., *Counsel.*

* * * * * * *

[fol. 1403] **PLAINTIFF'S EXHIBIT No. 38d**

License Agreement between The National Piston Company, Gustave E. Franquist, James E. Diamond and The Cleveland Trust Company, Dated April 11, 1924.

(Filed January 27, 1934.)

AGREEMENT

This Agreement made and entered into this 11th day of April, 1924, by and between The National Piston Company, Incorporated, a corporation of the State of New York, Gus-

tave E. Franquist, of Rochester, N. Y. and James E. Diamond, of Mount Vernon, N. Y. jointly and severally, (hereinafter referred to as Parties of the First Part) and The Cleveland Trust Company of Cleveland, Ohio, a corporation of the State of Ohio, (Hereinafter referred to as the Trust Company).

Witnesseth:

Whereas, the Parties of the First Part own the entire right, title and interest in and to United States Letters Patent, No. 1,153,902, issued September 21, 1915, to Gustave E. Franquist and,

Whereas, Parties of the First Part desire, under certain conditions, to dispose of their interest in and to the said patent and in any other patents or applications for Letters Patent relating to pistons per se* which they may own wholly or in part, or subsequently acquire, and

Whereas, The Trust Company desires to obtain the entire right, title and interest in and to the said patent to Franquist and the entire right, title and interest possessed by the Parties of the First Part, and each of them, in and to any other patents or applications relating to pistons per se now owned or subsequently acquired by the parties of the First Part together with certain rights to past infringements of the said patent or patents and application or applications.

Now, Therefore, in consideration of the covenants and agreements of the parties hereto, respectively, as hereinafter set forth, said parties have covenanted and agreed, and do hereby covenant and agree with each other as follows:

[fol. 1404] 1. The Parties of the First Part agree to sell, assign, transfer and set over to and hereby do sell, assign, transfer and set over to The Cleveland Trust Company as trustee under certain Conveyance, Declaration of Trust and Agreement dated March 7, 1922, a copy of which is at-

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* Pistons per se means pistons whose patentability depends upon physical, structural characteristics of the piston and not upon the character of the material in the piston or the molds, machines or the processes by which the piston is made.

tached, marked "Exhibit A"* and another copy of which is on file with the Trust Company, the entire right, title and interest in and to United States Letters Patent No. 1,153,902, issued September 21, 1915, and the entire right, title and interest possessed by the Parties of the First Part, and each of them, in and to any Letters Patent or applications for Patent relating to pistons per se now owned, held, wholly or in part, on the date of execution of this agreement or subsequently acquired; together with the right to sue and collect for all past infringements of the said patent or patents, or of any patent or patents issuing from such application or applications, and to collect damages and profits arising out of such infringement and apply the same to the benefit of The Cleveland Trust Company as trustee; except that this assignment does not convey or intend to convey to The Trust Company the right to sue for and collect for past infringement of said Franquist patent by Walker M. Levett of The W. M. Levett Corporation or the Walker M. Levett Company, of New York City.

2. The Trust Company hereby agrees forthwith upon the execution of this agreement to issue in the name of and transfer to the said Parties of the First Part, or their nominee or nominees, three hundred (300) shares in the beneficial interest created by said Conveyance, Declaration of Trust and Agreement, of which "Exhibit A" is a copy.

3. The Parties of the First Part hereby agree for themselves, their respective executors and legal representatives, to execute and deliver to The Cleveland Trust Company, as trustee, any and all other papers or documents necessary or desirable more fully to convey to The Cleveland Trust Company, as trustee, the entire right, title and interest in and to the said Letters Patent and applications, when, and as, the same may be requested by The Cleveland Trust Company, as trustee, and to do any and all further acts which may be desirable or necessary more effectually to secure [fol. 1405] to or vest in The Cleveland Trust Company, as trustee, its successors and assigns the entire right, title and interest in and to the said invention, Letters Patent and

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* PRINTER'S NOTE:

The "Exhibit A," referred to above was not attached to Exhibit 38d.

applications hereby sold, assigned and transferred or intended so to be.

4. The Parties of the First Part hereby agree for themselves, their respective executors and legal representatives, to assign to The Cleveland Trust Company, as trustee, without further consideration the entire right, title and interest in and to any United States Letters Patent or application relating to pistons per se which they may in the future acquire forthwith upon obtaining the same together with whatever rights they may acquire to sue and collect for past infringement thereof and to apply any damages and profits so recovered to the benefits of The Cleveland Trust Company, as Trustee.

5. In case the sub-license from the Aluminum Company of America to The National Piston Company, Incorporated, a copy of which is attached hereto, made a part hereof and marked "Exhibit B,"* is cancelled or terminated for any reason whatsoever, excepting the failure of The National Piston Company, Incorporated, reasonably to comply with its obligations thereunder, and said The National Piston Company, Incorporated, forthwith applies to whomsoever then holds or controls as owner or exclusive licensee, the inventions, applications for Letters Patent and Letters Patent embraced by such sub-license, for another sub-license upon terms at least as favorable for The National Piston Company, Incorporated, as those in said sub-license "B" contained, and such owner or exclusive licensee as the case might be, fails to execute or deliver to The National Piston Company, Incorporated, such a sub-license within thirty (30) days from the date of such application by said The National Piston Company, Incorporated, then and in that event, this agreement shall be deemed and construed henceforth to operate as such a sub-license having the terms and conditions of the sub-license, Exhibit "B," applicable for such purpose and The National Piston Company, Incorporated, shall account thereunder directly to The Trust Company.

[fols. 1406-1407] 6. This agreement, in the construction of which the laws of the State of Ohio shall govern, is made

*PRINTER'S NOTE:
The "Exhibit B" referred to above was not attached to Exhibit 38d.

by the Trust Company under title conveyed by or acquired under and subject to the terms, provisions and conditions of said certain Conveyance, Declaration of Trust and Agreement, of which "Exhibit A" is a copy.

In Witness Whereof the parties hereto have set their hands and affixed their seals this 11th day of April 1924.

THE NATIONAL PISTON COMPANY,
INCORPORATED,
HENRY MONKLEY,
President,

J. E. DIAMOND,

GUSTAVE E. FRANQUIST.

Attest:

J. E. DIAMOND,
[*Secretary.*]*
Vice Pres.

THE CLEVELAND TRUST COMPANY,
R. A. MALM,
Vice-President.

Attest: (Corporate Seal)

A. J. PERFLER,
Ass't Trust Officer.

Approved for Execution by The C. T. Co.
R. T. S., *Counsel.*

* * * * * * *

[fol. 1408] **PLAINTIFFS' EXHIBIT No. 38e**

License Agreement between Kant-Skore Piston Company and The Cleveland Trust Company, dated April 11, 1924

(Filed January 27, 1934)

Apr. 11, 1924

AGREEMENT

This Agreement made and entered into this 11th day of [March]* April, 1924, by and between The Kant-Skore Piston Company, an Ohio Corporation of Cincinnati, Ohio, (hereinafter sometimes referred to as Kant-Skore) and

[* Matter enclosed in brackets struck out in copy.]

The Cleveland Trust Company of Cleveland, Ohio, a corporation of the State of Ohio, (hereinafter referred to as The Trust Company)

Witnesseth:

Whereas, Kant-Skore owns the entire right, title and interest in and to United States Letters Patent

Hater, 1,485,078, February 26, 1924.

and an application for United States Letters Patent Serial No. 588,473, filed in the name of Hater.

Whereas, Kant-Skore desires, under certain conditions, to dispose of their interest in and to the said patents and in any other patents or applications for Letters Patent relating to pistons per se * which they may own wholly or in part, or subsequently acquire, and

Whereas, The Trust Company desires to obtain the entire right, title and interest in and to the said patents and the entire right, title and interest possessed by Kant-Skore in and to any other patents or applications relating to pistons per se now owned or subsequently acquired by Kant-Skore together with certain rights to past infringements of the said patent or patents and application or applications.

Now, Therefore, in consideration of the covenants and agreements of the parties hereto, respectively as herein-[fol. 1409] after set forth, said parties have covenanted and agreed, and do hereby covenant and agree with each other as follows:—

1. Kant-Skore agrees to sell, assign, transfer and set over to and hereby sells, assigns, transfers and sets over to The Cleveland Trust Company as trustee of a certain beneficial interest created by a certain Conveyance, Declaration of Trust and Agreement dated March 7th, 1922, copy of which is attached, marked "Exhibit A," ** and another copy of which is on file with The Trust Company,

* Pistons per se means pistons whose patentability depends upon physical, structural characteristics of the piston and not upon the character of the material in the piston or the molds, machines or the processes by which the piston is made.

** PRINTER'S NOTE:

The "Exhibit A" referred to above was not attached to Exhibit 38e.

the entire right, title and interest in and to United States Letters Patent, and applications enumerated above, and the entire right, title and interest possessed by Kant-Skore in and to any Letters Patent or applications for Letters Patent relating to pistons per se now owned, held, wholly or in part, on the date of the execution of this agreement or subsequently acquired; together with the right to sue for past infringements of the said patent or patents, or of any patent or patents issuing from such application or applications, and to collect damages and profits arising out of such infringement and apply the same to the benefit of The Cleveland Trust Company, as trustee. It is agreed that whatever right Kant-Skore now owns in or under the Spillman patent No. 1,325,176, December 16, 1919, is not transferred to The Trust Company by this agreement.

2. The Trust Company hereby agrees forthwith upon the execution of this agreement to issue in the name of and transfer to Kant-Skore fifty (50) shares in the beneficial interest created by and under said certain Conveyance, Declaration of Trust and Agreement, of which exhibit "A" is a copy.

3. Kant-Skore hereby agrees for itself, successors and its legal representatives to execute and deliver to The Cleveland Trust Company as Trustee any and all other papers or documents necessary or desirable more fully to convey to The Cleveland Trust Company, as Trustee, the entire right, title and interest in and to the said inventions, Letters Patent and applications and each of them hereby sold, assigned and transferred or intended so to be when, and as, the same may be requested by The Trust Company, [fol. 1410] as Trustee, its successors and assigns.

4. Kant-Skore hereby agrees to assign to The Cleveland Trust Company, as Trustee, without further consideration, the entire right, title and interest in and to any United States Letters Patent or application relating to pistons per se which it may in the future acquire forthwith upon obtaining the same together with whatever rights they may acquire to sue and collect for past infringement thereof and to apply any damages and profits so recovered to the benefit of The Cleveland Trust Company as trustee.

5. In case the sub-license from the Aluminum Company of America to the Kant-Skore Company, a copy of which

is attached hereto, made a part hereof, and marked "Exhibit B," * is cancelled or terminated for any reason whatsoever, excepting the failure of Kant-Skore Company reasonably to comply with its obligations thereunder, and said Kant-Skore Company forthwith applies to whomsoever then holds or controls as owner or exclusive licensee, the inventions, applications for Letters Patent and Letters Patent embraced by such sub-license for another sub-license upon terms at least as favorable for Kant-Skore Company as those in said sub-license "B" contained, and such owner or exclusive licensee as the case might be, fails to execute or deliver to Kant-Skore Company such a sub-license within thirty (30) days from the date of such application by said Kant-Skore Company, then and in that event, this agreement shall be deemed and construed henceforth to operate as such a sub-license having the terms and conditions of the sub-license, Exhibit "B," applicable for such purpose and Kant-Skore Company shall account thereunder directly to The Trust Company.

6. This agreement, in the construction of which the laws of the State of Ohio shall govern, is made by The Trust Company under title conveyed by or acquired under and subject to the terms, provisions and conditions of said certain Conveyance, Declaration of Trust and Agreement, of which exhibit "A" is a copy.

[fol. 1411] In Witness Whereof the parties hereto have set their hand and affixed their seal this 11th day of April, 1924.

The Cleveland Trust Company, By R. A. Malm, Vice President.

Attest: A. J. Perfler, Ass't Trust Officer.

The Kant-Skore Piston Company, By H. J. Hater, V. P.

Attest: R. T. Mesker, Secy.

Approved for Execution by The C. T. Co., R. T. S., Counsel.

* * * * * * *

* PRINTER'S NOTE:

The "Exhibit B" referred to above was not attached to Exhibit 38e.

[fol. 1412] **PLAINTIFFS' EXHIBIT No. 39a**

Letter from Aluminum Company of America to The Cleveland Trust Company, dated September 19, 1927

(Filed January 27, 1934)

Cleveland, Ohio, September 19, 1927

The Cleveland Trust Company, Trustee under Declaration of Trust and Agreement between L. P. Mooers et al., dated March 7, 1922, Cleveland, Ohio.

Gentlemen:

We hereby consent to your executing and carrying out the agreement dated October 12th, 1927, between The Cleveland Trust Company, Trustee, and Bohn Aluminum & Brass Corporation, which has been initialled by Mr. W. P. King, and the license agreement dated as of Oct. 12th as of Sept. 15th, 1927, between The Cleveland Trust Company, Trustee, as Licensor and Bohn Aluminum & Brass Corporation as Licensee, which has also been initialled by Mr. W. P. King,—it being understood that said license agreement is to be carried out according to the terms thereof and is not to be changed or modified without our consent; and provided that either the agreements between The Cleveland Trust Company and Walker M. Levett Company, et al., and The National Piston Company, et al., respectively, each dated April 11, 1924, shall be surrendered and cancelled, or all rights under paragraph four of the former agreement and paragraph five of the latter agreement be waived and extinguished.

This letter of consent or authority to execute shall continue unless extended for a further period at that time, until thirty days from date hereof.

Very truly yours,

Aluminum Company of America, By W. P. King, Vice-President.

[fol. 1413] **PLAINTIFFS' EXHIBIT No. 39b**

Letter from Aluminum Company of America to The Cleveland Trust Company, dated October 12, 1927

(Filed January 27, 1934)

Detroit, Mich., October 12, 1927.

The Cleveland Trust Company, Trustee under Declaration of Trust and Agreement between L. P. Mooers et al., dated March 7, 1922, Cleveland Ohio.

Gentlemen:

Supplementing our letter of September 19, 1927, to you we beg to say that it is understood and we hereby agree, that in case we surrender the license heretofore granted to us by you under date of April 26, 1924, any re-assignment of the patents, patent applications or other patent rights which have been assigned by us to you under said license agreement, shall be made subject to the license granted by you to the Bohn Aluminum & Brass Corporation by the agreement [dated]* executed this day [1927]* between you and the Bohn Aluminum & Brass Corporation, the execution of which on your part we consented to in our letter of September 19th, 1927.

Very truly,
Aluminum Company of America, By W. P. King,
Vice President.

[fol. 1414] **PLAINTIFFS' EXHIBIT No. 39c**

License Agreement between The Cleveland Trust Company and Bohn Aluminum & Brass Corporation, dated September 15, 1927, with Lists A and B Attached

(Filed January 27, 1934)

License Agreement

This License Agreement, made and entered into by and between The Cleveland Trust Company, of Cleveland, Ohio as Trustee under the Declaration of Trust and Agreement

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[* Matter enclosed in brackets struck out in copy.]

between L. P. Mooers et al. and The Cleveland Trust Company, dated March 7, 1922, hereinafter sometimes called the Licensor, and Bohn Aluminum & Brass Corporation, a Michigan corporation of Detroit, Michigan, hereinafter sometimes called the Licensee, witnesseth:—

Whereas the Licensor owns the entire right, title and interest in and to the Letters Patent and applications for Letters Patent in the United States as set forth in List A, attached hereto, and has arranged to acquire the entire right, title and interest in and to the Letters Patent and applications set forth in List B, attached hereto; and

Whereas, the Licensor may acquire other United States patents, patent applications and patent rights relating to pistons per se* during the life of this agreement; and

Whereas, the said Licensee is desirous of acquiring a license to make, use and sell the inventions included in the said patents and applications acquired and to be acquired by the Licensor for the full term for which said patents are or shall be granted;

Now, Therefore, in consideration of the premises and of the covenants and agreements of the parties hereto, respectively, as hereinafter set forth, said parties have covenanted and agreed, and do hereby covenant and agree with each other as follows:

[fol. 1415] *Amended—January 1, 1928*

I

The Licensor grants the Licensee the non-exclusive right to make, use and sell a maximum of five million (5,000,000) pistons and/or piston castings per accounting year (each year beginning July 1st) embodying any of the inventions covered by any of the patents and applications in the above named lists, being all of the patents and applications for patents relating to pistons per se now owned by the

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* Pistons per se means pistons whose patentability depends upon physical, structural characteristics of the piston and not upon the character of the material in the piston or the molds, machines or the processes by which the piston is made.

Licensor, or to be covered by any continuations and divisions, renewals or reissues of the same, for the full term of each of said patents throughout the United States, the territories and possessions thereof. In case the Licensee makes and sells no so-called controlled type* pistons or castings which are, after sale, modified or to be modified into controlled type pistons, during any accounting year, the maximum of five million pistons and/or piston castings provided herein for that year is waived and the number of pistons and/or piston castings the licensee may make hereunder for that year is unlimited. This license and agreement will be automatically extended to cover any other and further patents or applications or other rights under patents which the Licensor may acquire relating to pistons per se, subject to the conditions imposed thereon when received by the Licensor, unless excluded therefrom by the Licensee as hereinafter provided, and the Licensor agrees to execute any further instruments and perform any further acts if any are required, to consummate the granting of such licenses to the Licensee.

II

The Licensor releases and discharges the Licensee, all its vendees and/or users of pistons, the castings for which were heretofore acquired from the Licensee, from any and all claims whatsoever for damages or profits by reason of any alleged past infringement of any of the patents in lists A and B hereto attached now owned by the Licensor and arising out of the manufacture, use and sale of such pistons; [fol. 1416] and from any claim or claims for past damages or profits under patents which shall be acquired by the Licensor in the future, during the continuance of this agreement, and under which the Licensee shall accept a license hereunder, and theretofore arising out of the manufacture, use and sale of such pistons; and agrees not to institute or to aid or abet the institution of any suit against

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* By controlled type of aluminum piston is meant any piston made in any part of a light metal or of an alloy of a specific gravity less than iron or steel, the expansion and contraction of which is controlled to any extent by any other metal with a coefficient of expansion different from that of the said light metal or alloy.

the Licensee, or the vendees or users of pistons, the castings for which were heretofore acquired from the Licensee, for any alleged past infringement of any patents relating to the subjects covered by the patents or applications named herein or for damages and profits because of alleged past infringement thereof and heretofore arising out of the manufacture, use and sale of such pistons.

III

1. (a) The Licensor shall institute and prosecute to a conclusion with due diligence suit or suits against any or all infringers of the patents included within the terms of this agreement necessary reasonably to protect the interests of the Licensee acquired hereunder, provided that the Licensor be indemnified to its satisfaction by the Licensee for any costs or expenses which the Licensor may suffer or sustain in connection with or growing out of any such suit.

(b) The Licensor shall defend any suit or suits, so far as such defense shall be necessary reasonably to protect the interests of the Licensee acquired hereunder, brought because of the alleged infringement of any Letters Patent covering the design of pistons made, sold or used under this agreement and for which royalties are paid under this agreement, provided that the Licensor be indemnified to its satisfaction by the Licensee for any costs or expenses which the Licensor may suffer or sustain in connection with or growing out of any such defense.

2. Should the Licensor bring and prosecute or defend as above provided such infringement suit or suits at its own expense, all profits or damages recovered in said suit or suits shall be the absolute property of the Licensor.

3. In the event of the failure of the Licensor promptly to institute and vigorously prosecute or to defend such suit or suits as may be necessary reasonably to protect the interests of the Licensee hereunder, then and in that event, the Licensee having reasonably indemnified the Licensor, [fol. 1417] may in the name of the Licensor or the names of the Licensor and Licensee jointly institute or adopt and diligently prosecute or defend at the Licensee's expense such suit or suits as may be required reasonably to protect its interests. The Licensor at any time shall have the right

to join in the prosecution or defense of such suit or suits with its own counsel and at its own expense.

4. Should the Licensee bring or prosecute or defend as above provided any such infringement suit or suits or should the Licensee furnish indemnification to the Licensor in connection with suits brought or prosecuted or defended by the Licensor and pay any sum on account of such indemnification, it shall have the right to apply all royalties payable by it on the reasonable costs and expenses of such suit or suits, including attorney's fees, or on said sum paid on account of indemnification and shall apply the sum, if any, recovered in any such suit, first, to the reimbursement of it for said reasonable expenses and costs, including attorney's fees, or sums paid on account of indemnification, and not theretofore reimbursed to it out of royalties, and second, to the payment to the Licensor of all sums theretofore deducted by the Licensee from royalties and applied to the said reasonable costs and expenses, including attorney's fees, of such suit or payments of indemnification, and the balance shall be the absolute property of the Licensee.

IV

The Licensee agrees that it will within the months of January, April, July and October of each year from and after the execution hereof, furnish to the Licensor, its successors or assigns in interest, a written statement under oath which shall show:—

(a) the number of pistons and piston castings made by or for it or imported by it, and used, sold * or otherwise disposed of by it during the preceding three calendar months, which contain or which to the Licensee's knowledge are to be modified or fabricated by the Licensee's vendees to contain and embody any invention covered by any of the claims of any of the Letters Patent and applications recited in Lists A and B hereto attached, or in the future acquired by the Licensor and included herein.

[fol. 1418] This report shall be made whether or not the Licensee makes, uses or sells any pistons and/or castings therefor during the preceding royalty period.

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*Sold in this contract means and includes only licensed pistons which are delivered during the period.

(b) the number of controlled type pistons and castings for controlled type pistons made by or for it or imported by it, and used, sold or otherwise disposed of by it during the preceding three calendar months.

This report shall be made whether or not the Licensee makes, uses or sells any controlled type pistons and/or castings therefor during the preceding royalty period.

(c) the number of such pistons and piston castings sold by the Licensee and for which the vendee has been subsequently credited.

The first report shall include the pistons and/or piston castings covered by this Article, used, sold or otherwise disposed of between [the date of this contract]* September fifteenth and October 1, 1927.

Alteration (OK)
B. A. & B. Corpn. PAM
The C. T. Co.—AJP
A. Co. of Am.—WPK

V

The Licensee will pay the Licensor a royalty of one cent (1¢) upon each piston used, sold or otherwise disposed of by the Licensee during the life of this agreement, embodying in its construction any invention covered by one or more of the claims of the Letters Patent and applications named in Lists A and B attached hereto, or in the future acquired by the Licensor and added hereto, and upon each piston casting sold or otherwise disposed of by the Licensee with the intention or the knowledge of the Licensee that it shall be modified or fabricated by the Licensee's vendee in such a way as to embody in its construction any invention covered by one or more of the claims in the said Letters Patent or applications.

It is understood that no royalties will be payable or collectible upon the licensed pistons or piston castings which have been sold and for which the vendee thereof has been subsequently credited, and that if any royalties have been paid upon the licensed pistons or piston castings which are [fol. 1419] sold, and for which the vendee has been subsequently credited, the Licensee shall have credit therefor upon the next due payment.

[*Matter enclosed in brackets, struck out in copy.]

VI

For the purpose of the interpretation of the provisions of this agreement, it is agreed that the commercial controlled type pistons heretofore manufactured, or for which castings have heretofore been manufactured, by Bohn Corporation and Aluminum Company of America, are covered by claims of the patents included in Lists A and B hereto attached.

VII

Within thirty (30) days after it shall have furnished, in January, April, July and October of each year, the statements specified in Article IV hereof, the Licensee shall and will pay to the Licensor, its successors or the assigns of its interest in said Letters Patent, the royalties upon the pistons and piston castings covered by said reports, at the rate prescribed.

VIII

The Licensee agrees that it will keep accurate books of account, giving full particulars of the Licensee's business with respect to the licensed pistons and piston castings covered by this agreement and will admit the Licensor or its duly accredited agent at all reasonable times to inspect the same.

IX

In the event that the combination set forth in any of the claims of the Letters Patent shown in Lists A and B hereto attached or of the applications for Letters Patent shown in said lists A and B and of the Letters Patent to be granted on said applications, and/or acquired in the future and added hereto, is held by a court of final jurisdiction or by an inferior court from whose decree no appeal is taken or the appeal is denied or dismissed, to be an infringement of any other patent (other than patents owned by the Licensee or under which the Licensee is licensed) in any patent suit brought in the United States against the Licensor, the Licensee, any other of the Licensor's licensees, any sub-licensees or any of its or their vendees, the Licensee shall have, and is hereby given, the right and option to exclude from this license any such claim or claims or the [fol. 1420] Letters Patent or applications for Letters Pat-

ent containing such claim or claims, as the case may be, and to have the royalty payable hereunder reduced proportionately to the reduction, if any, caused by such judicial holdings, in the value of the patents and applications comprehended by this agreement, such proportion to be determined by arbitration as hereinafter in Paragraph XVIII hereof provided, or to terminate this agreement altogether, by giving to the Licensor notice in writing of its election so to do within six (6) months from the rendition of the judicial holding of the court of final jurisdiction or after the expiration of the time for appeal or after the appeal has been denied or dismissed.

X

This agreement and license shall be transferable only to the successors or assigns of the entire casting business of the Licensee or the entire business of either of the parties hereto, but in that event the successors or assigns shall be bound by the provisions of this agreement and obligated to conform thereto; provided, however, that any successor to The Cleveland Trust Company, as Trustee under said Declaration of Trust and Agreement, dated March 7, 1922, shall be deemed, for the purposes hereof, to be the successor and assign of the entire business of the Licensor.

XI

The Licensee will not during the life of this agreement contest, or aid others in contesting, the scope or validity of any of the Letters Patent included within this agreement or afterwards acquired by the Licensor and included in this agreement.

XII

The Licensee hereby is given the right and option to exclude from this license any Letters Patent or applications for Letters Patent or other patent rights which the Licensor may acquire after the execution of this license, provided the Licensee gives the Licensor notice in writing of such exclusion within ninety (90) days after notice in writing to the Licensee by the Licensor of the acquisition of such Letters Patent or applications or other patent rights.

[fol. 1421]

XIII

The Licensee shall pay royalties only upon pistons and piston castings delivered during the term of this license.

XIV

If either of the parties hereto neglects or refuses to keep any of its covenants herein, then the other party hereto may serve on the derelict party by registered mail a notice in writing of such default and if the derelict party shall continue such default for thirty (30) days after the serving of such notice, then the aggrieved party may at its option cancel this license by a notice in writing of such cancellation and termination, provided, however, that the foregoing remedy shall not exclude any other remedy which the aggrieved party may have at law or in equity. The waiver of any breach by either party shall not be interpreted as constituting a waiver of any further breach or breaches.

XV

The Licensor hereby grants to the Licensee the right to make, use and sell in the United States pistons embodying the inventions covered by any foreign patents or applications for foreign patents, which the Licensor now owns or controls, or in the future acquires, for sale and use in foreign countries covered by said patents and/or applications. The Licensor releases the Licensee, its vendees and all users of its pistons, from any claim or claims for alleged infringement of foreign patents, which the Licensor now has or in the future may acquire and under which the Licensee may accept a license as herein provided. The Licensor agrees, upon demand of the Licensee, to execute all instruments and perform all acts necessary to grant the licenses under this paragraph. This license and agreement will be automatically extended to cover pistons under any other and further foreign patents or applications for foreign patents or other rights under foreign patents on pistons per se which the Licensor may acquire in the future, unless excluded therefrom by the Licensee as provided for in this contract and the Licensor agrees to execute any further instruments and perform any further acts, if any are required, to consummate the granting of licenses to the Licensee under this section of this agreement.

[fol. 1422]

XVI

The Licensee shall use reasonable diligence in manufacturing and/or marketing pistons embodying inventions, licensed hereunder, and, in the event that, during the con-

tinuance of this agreement, it should not do so, the Licensor shall have the following right, option and privilege exercisable by it forthwith upon the finding by arbitration as hereinafter provided that the Licensee has not used and is not using such diligence:

(a) To cancel or terminate this agreement by giving six (6) months' notice in writing to the said Licensee of its desire and intentions so to do; whereupon at the expiration of said six (6) months from the date of said notice this agreement shall be terminated.

XVII

Should the Licensee, taking advantage of its privilege under any of the provisions of this contract, elect to terminate this contract and stand out from under the same, the Licensee shall not be estopped to deny the validity of any of the patents covered or comprehended by this contract and shall not be deprived of any of the defenses or the rights of a defendant in an ordinary patent infringement suit, but, on the contrary, shall stand in the position of one who had never entered into this contract.

XVIII

In the event either party hereto calls for an arbitration as provided for in this contract, each party shall select an arbitrator and the two arbitrators shall select a third arbitrator. In the event that the two arbitrators fail to select a third or in the event either party fails to select its arbitrator, it is agreed that the third and/or second arbitrator may be selected by the district judge of the United States District Court, Northern District of Ohio, Eastern Division, who has then been longest in said office. The three arbitrators thus selected shall constitute the Board of Arbitration and the parties hereto shall submit their contentions to this Board of Arbitration at a time and in a manner determined by the arbitrators. The decision of any two arbitrators shall be final and binding on the parties hereto. Each party shall bear the expense of its arbitrator and both shall bear the expense of the third arbitrator share and share alike.

[fol. 1423] XIX

The Licensor agrees that should it at any time during the life of this agreement grant licenses under the patents,

now included, or in the future included, in this agreement, or under the substantial and material patents now included or to be included in this agreement, at lower rates than one cent ($.01) per piston as provided for herein, or otherwise upon more favorable terms than are provided for herein, then, upon request of Licensee, this agreement shall be modified to make its terms as favorable as those upon which any such subsequent license may be granted.

XX

Amended—January 1, 1928

Except as otherwise provided in Article I hereof, this licensee is limited to five million (5,000,000) pistons and piston castings (together) per accounting year. If the Licensee exceeds that amount in any accounting year without the written consent of the Licensor, and of the Licensor's other licensee (being the exclusive licensee except for this license) under the patents held in the Licensor's trust estate, then the Licensor shall charge and collect an additional royalty of ten cents (10¢) per piston for all pistons and piston castings in excess of the maximum five million (5,000,000) which additional royalty shall be paid by the Licensee to the Licensor on demand, and the Licensor shall diligently proceed by proper proceedings to enjoin and prevent any further such violation of the provisions of this license, or, failing so to enjoin and prevent such violation, the Licensor shall cancel this license.

XXI

This agreement is made by the Licensor under title conveyed by or acquired under and subject to the terms, provisions and conditions of a certain Conveyance, Declaration of Trust and Agreement entered into as of the 7th day of March, 1922, by and between Louis P. Mooers and George B. Pitts and The Cleveland Trust Company, Trustee, the Licensor herein, a copy of which is on file at the principal office of said The Cleveland Trust Company in the City of Cleveland, and open to the inspection of the Licensee, and unless terminated as hereinbefore provided, shall terminate with the date of expiration of the last Letters Patent now or hereafter embraced in said Declaration of Trust and Agreement.

[fol. 1424-1425] XXII

Upon the execution and delivery hereof, Bohn Corporation shall surrender and cancel all of the Sub-licenses under the patents held by the Trust Company which said Bohn Corporation or any of its subsidiary or affiliated companies own.

XXIII

The non-exclusive license granted by this agreement does not convey to the Licensee any rights to grant any sub-licenses thereunder.

In Witness Whereof, the parties hereto have caused this instrument to be executed in duplicate by their respective officers thereunto duly authorized October 12, 1923 as of the 15th day of September, A. D. 1927.

Bohn Aluminum & Brass Corporation,
By P. A. Markey,
Vice-President,
R. T. G.

A. P. Lauer,
Secretary.
(Corporate Seal)

The Cleveland Trust Company, Trustee,
By R. A. Malm,
Vice-President,

A. J. Perfler,
Assistant Trust Officer.
(Corporate Seal)

Approved for Execution by The C. T. Co.
R. T. S., *Counsel.*

* * * * * * *

[fol. 1426] LIST A

Patent Number	Patentee	Date
Re 16,273	R. M. Howdeshell	Feb. 23, 1926
1,092,870	Spillman & Mooers	Apr. 14, 1914
1,153,902	G. E. Franquist	Sept. 21, 1915
1,279,184	J. G. Vincent	Sept. 17, 1918
1,293,846	H. C. Marmon	Feb. 11, 1919

Patent Number	Patentee	Date
1,327,147	H. D. Church	Jan. 6, 1920
1,371,320	C. A. Marien	Mar. 15, 1921
1,347,819	L. P. Mooers	July 27, 1920
1,388,279	C. A. Marien	Aug. 23, 1921
1,402,308	L. P. Mooers	Jan. 3, 1922
1,402,309	L. P. Mooers	Jan. 3, 1922
1,408,066	W. B. & M. Berry	Feb. 28, 1922
1,473,233	R. M. Howdeshell	Nov. 6, 1923
1,551,233	W. G. Berry, et al.	Aug. 25, 1925
1,563,025	H. J. Hater	Nov. 24, 1925

Serial No.	Applicant	Filing Date
563,782	Gustave E. Franquist	May 26, 1922
88,706	Stephen D. Hartog	Feb. 16, 1926
100,496	Harold J. Ness	Apr. 8, 1926
100,497	Harold J. Ness	Apr. 8, 1926
133,909	William C. McCoy	Sep. 7, 1926
143,878	William C. McCoy	Oct. 25, 1926
143,879	William C. McCoy	Oct. 25, 1926
467,587	Stephen D. Hartog	May 7, 1921
470,502	Gustav R. Kelm	May 18, 1921 Renewed Sep. 15, 1923
561,997	James E. Diamond	May 18, 1922
649,481	Louis P. Mooers	July 5, 1923
204,661	Edward J. Gulick	Nov. 30, 1917

[fol. 1427]

LIST B

Inventor	Patent Number	Date
Wasson	1,320,188	10-28-19
Napier	1,403,560	1-17-22
Parkhurst	1,440,549	1- 2-23
Wills	1,441,468	1- 9-23
Pomeroy	1,499,073	6-24-24
Napier	1,525,316	2- 3-25
Jardine	1,563,194	11-24-25
Jardine & Jehle	1,580,491	4-13-26

Applicant	Serial Number	Filing Date
Jardine	450,898	3- 9-21
Jehle & Jardine	544,487	3-17-22

Applicant	Serial Number	Filing Date
Jardine & Jehle	615,324	1-27-23
Welty	39,676	6-26-25
Jardine	47,214	7-31-25
Welty	47,220	7-31-25
Jardine	47,234	7-31-25
Norton	51,748	8-22-25
Jardine	57,838	9-22-25
Jardine	79,527	1- 6-26
Jardine & Cooper	79,651	1- 6-26
Jardine & Cooper	79,800	1- 7-26
Welty	80,173	1- 9-26
Norton	80,902	1-13-26
Evans	84,894	1-30-26
Jardine	100,771	4- 9-26
Jardine	100,772	4- 9-26
Jardine	100,773	4- 9-26
Jardine	100,774	4- 9-26
Welty	128,764	8-12-26
Jardine	137,194	9-23-26
Jardine & Cooper	174,202	3-10-27
Norton	Docket No. 2799 being prepared	
Welty	Docket No. 2834 being prepared.	

[fol. 1428] **PLAINTIFFS' EXHIBIT No. 39d**

Letter from Aluminum Company of America to The Cleveland Trust Company, dated September 19, 1927

(Filed January 27, 1934.)

Aluminum Company of America

Warren P. King
Vice-President

Cleveland, O., September 19, 1927.

The Cleveland Trust Company, Trustee under Declaration of Trust between L. P. Mooers et al., dated March 7, 1922.

Cleveland, Ohio.

Gentlemen:

We beg to advise that we recognize that the commercial controlled type pistons heretofore manufactured, or for

which castings have heretofore been manufactured, by us, are covered by claims of one or more of the patents included in lists A and/or B attached hereto.

Very truly yours,

ALUMINUM COMPANY OF AMERICA,
By W. P. KING,
Vice-President.

P:L

PRINTER'S NOTE:

Lists A and B, attached to the original hereof, having been printed as part of Plaintiffs' Exhibit No. 39c, supra, have been omitted at this point to comply with the rule against duplication.

[fol. 1429] **PLAINTIFFS' EXHIBIT No. 39e**

Letter from Aluminum Company of America to The Cleveland Trust Company, dated April 26, 1928

(Filed January 27, 1934)

Cleveland, Ohio, April 26, 1928.

The Cleveland Trust Company, Trustee under Declaration of Trust and Agreement between L. P. Mooers et al., dated March 7, 1922, Cleveland, Ohio.

Gentlemen:

We hereby consent to your executing the Amendment to the License Agreement between The Cleveland Trust Company, Trustee, Licensor, and Bohn Aluminum and Brass Corporation, Licensee, dated as of January 1, 1928, but made April 25, 1928, which has been signed by the officers of Bohn Aluminum and Brass Corporation and acknowledged by them under date of April 14, 1928, it being understood that the License Agreement executed on October 12, 1927, as of September 15, 1927, between The Cleveland Trust Company, Trustee, as Licensor, and Bohn Aluminum and Brass Corporation as Licensee, as amended by the said Amendment thereto hereinabove mentioned, is to be carried

out according to the terms thereof and is not to be further changed or modified without our consent.

Very truly yours,

ALUMINUM COMPANY OF AMERICA,
By W. P. King,
Vice-President,

P:L

[fol. 1430] **PLAINTIFFS' EXHIBIT No. 39f**

(Defendants' Exhibit 4-U)

License Agreement between The Cleveland Trust Company and Bohn Aluminum & Brass Corporation

(Filed January 27, 1934)

LICENSE AGREEMENT

THE CLEVELAND TRUST COMPANY TO BOHN ALUMINUM AND BRASS CORPORATION—October 12, 1927

Amended—Jan. 1, 1928.
Amended—Dec. 24, 1929.

This Agreement, made and entered into [as of]* on the 25th day of April, 1928, as of the first day of January 1928 by and between The Cleveland Trust Company, of Cleveland, Ohio, as Trustee under the Declaration of Trust and Agreement between L. P. Mooers et al. and The Cleveland Trust Company, dated March 7, 1922, hereinafter sometimes called the "Licensor," and BOHN ALUMINUM AND BRASS CORPORATION, a Michigan corporation, of Detroit, Michigan, hereinafter sometimes called the "Licensee,"

WITNESSETH:

WHEREAS said The Cleveland Trust Company, as Trustee as aforesaid, and the Bohn Aluminum and Brass Corporation heretofore entered into a certain License Agreement, executed on the 12th day of October, 1927, as of the 15th day of September, 1927, wherein said Trust Company, as said Trustee, is Licensor and the Bohn Aluminum and Brass Corporation is Licensee; and

WHEREAS the parties thereto desire to modify and amend said License Agreement as hereinafter provided;

[*Matter enclosed in brackets, struck out in copy.]

Now, Therefore, it is agreed by and between the parties hereto—each party hereto making its promises and agreements herein contained in consideration of the promises and agreements of the other party herein contained—as follows, to wit:

1. The first two sentences of Article I of the said License Agreement, executed October 12, 1927, as of September 15, 1927, are hereby modified and amended so as to read as follows:

[fol. 1431] The Licensor grants the Licensee the non-exclusive right to make, use and sell a maximum of ten million (10,000,000) pistons and/or piston castings per accounting year (each year beginning January 1st) embodying any of the inventions covered by any of the patents and applications in the above named lists, being all of the patents and applications for patents relating to pistons per se now owned by the Licensor, or to be covered by any continuations and divisions, renewals or reissues of the same, for the full term of each of said patents throughout the United States, the territories and possessions thereof. In case the Licensee makes and sells no so-called controlled type* pistons or castings which are, after sale, modified or to be modified into controlled type pistons, during any accounting year, the maximum of ten million pistons and/or piston castings provided herein for that year is waived and the number of pistons and/or piston castings the licensee may make hereunder for that year is unlimited.

2. Article XX of the said License Agreement, executed October 12, 1927, as of September 15, 1927, is hereby modified and amended so as to read as follows:

Except as otherwise provided in Article I hereof, this license is limited to ten million (10,000,00) pistons and piston castings (together) per accounting year. If the Licensee exceeds that amount in any accounting year without the written consent of the Licensor, and of the Licensor's other licensee (being the exclusive licensee except for this license)

* By controlled type of aluminum piston is meant any piston made in any part of a light metal or of an alloy of a specific gravity less than iron or steel, the expansion and contraction of which is controlled to any extent by any other metal with a coefficient of expansion different from that of the said light metal or alloy.

under the patents held in the Licensor's trust estate, then the Licensor shall charge and collect an additional royalty of ten cents (10¢) per piston for all pistons and piston castings in excess of the maximum ten million (10,000,000), which additional royalty shall be paid by the Licensee to the Licensor on demand, and the Licensor shall diligently proceed by proper proceedings to enjoin and prevent any further such violation of the provisions of this license, or, [fols. 1432-1433] failing so to enjoy and prevent such violation, the Licensor shall cancel this license.

3. Except as hereinabove otherwise specifically provided, the said agreement executed October 12, 1927, as of September 15, 1927, shall remain unchanged and in full force and effect.

In Witness Whereof, the parties hereto have caused this instrument to be executed in duplicate by their respective officers thereunto duly authorized as of the day and year first above written.

Bohn Aluminum and Brass Corporation, by P. A. Markey, Vice-President. S. D. Den Uyl, Ass't Secretary.

The Cleveland Trust Company, Trustee, by R. A. Malm, Vice-President. A. J. Perfler, Assistant Trust Officer.

Approved for execution by the C. T. Co.
A. J. P., Ass't Counsel.

• • • • • • •

[fol. 1434] **PLAINTIFFS' EXHIBIT NO. 39g**

Letter from Aluminum Company of America to The Cleveland Trust Company, dated December 24, 1929

(Filed January 27, 1934)

Cleveland, Ohio, December 24, 1929.

The Cleveland Trust Company, Trustee under Declaration of Trust and Agreement between L. P. Mooers et al., dated March 7, 1922, Cleveland, Ohio.

GENTLEMEN:

We hereby consent to your licensing Bohn Aluminum & Brass Corporation to make, use and sell a maximum of Eleven Million (11,000,000) pistons and/or piston castings

during the accounting year beginning January 1, 1929, and ending December 31, 1929, under the License Agreement dated September 15, 1927, and actually executed October 12, 1927, between you as Licensor and Bohn Aluminum and Brass Corporation as Licensee, as amended by Agreement made on April 25, 1928, as of January 1, 1928, (being One Million (1,000,000) pistons and/or piston castings more than provided in said Agreement as so amended) it being understood that all other terms and provisions of said License Agreement as amended on April 25, 1928, shall be and remain in full force and effect and that the said One Million (1,000,000) increase in the number of licensed pistons and/or piston castings applies to said accounting year 1929 only, and that the maximum number of licensed pistons and/or piston castings for each accounting year subsequent to the said accounting year 1929 shall be Ten Million (10,000,000), and that the said license Agreement executed on October 12, 1927, as of September 15, 1927, between you as Licensor and Bohn Aluminum & Brass Corporation as Licensee, as amended by the said Agreement made April 25, 1928, as of January 1, 1928, except as to the said increase of One Million (1,000,000) in the number of pistons and/or piston castings licensed for the year 1929, is to be carried out according to the terms thereof and is not to be further changed or modified without our consent.

Very truly yours, Aluminum Company of America,
by W. P. King, Vice-President.

[fol. 1435] **PLAINTIFFS' EXHIBIT NO. 40**

Agreement between Bohn Aluminum & Brass Corporation and The Cleveland Trust Company, dated October 12, 1927, Under Schmiedeknecht Patent No. 1,256,265

[Offered also as Defendants' Exhibit 4-V]

(Filed September 27, 1934)

Agreement

This Agreement made and entered into this 12th day of October, 1927, by and between the Bohn Aluminum & Brass Corporation, a Michigan corporation, of Detroit, Michigan, hereinafter sometimes called the "Bohn Corporation," and The Cleveland Trust Company, an Ohio corporation, of

Cleveland, Ohio, as Trustee under the Declaration of Trust and Agreement between L. P. Mooers, et al., dated March 7, 1922, hereinafter sometimes called the "Trust Company,"

Witnesseth:

Whereas the Bohn Aluminum & Brass Corporation owns the entire right, title and interest in and to United States Letters Patent No. 1,256,265, issued to Victor E. Schmiedeknecht on February 12, 1918, and an application for United States Letters Patent, Serial No. 201650, filed in the name of Frank J. Kent, both of which are for certain inventions relating to pistons per se;* and

Whereas the Bohn Corporation is a large manufacturer of aluminum pistons; and

Whereas the Trust Company, as Trustee as aforesaid, owns various patents relating to pistons per se; and

Whereas the Trust Company, as Trustee as aforesaid, desires to obtain the patent and the application for patent above named and to have the said Bohn Corporation accept a license under the patents in said trust estate, relating to pistons per se, by the terms of which said Bohn Corporation recognizes said patents and agrees to pay one cent (1¢) per piston royalty upon the pistons and/or castings therefor, made, used and/or sold by it, which are covered by said patents, or any of them; and

[fol. 1436] Whereas said Bohn Corporation is willing to sell and assign to said Trust Company, as Trustee as aforesaid, the patent and the application for patent above named and to accept a license from said Trust Company upon the terms and conditions hereinafter provided for;

Now, Therefore, it is agreed by and between the parties hereto, each party hereto making its promises and agreements herein contained in consideration of the promises and agreements of the other party herein contained—each of said promises and undertakings being material and dependent—as follows, to wit:

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* Pistons per se means pistons whose patentability depends upon physical, structural characteristics of the piston and not upon the character of the material in the piston or the molds, machines or the processes by which the piston is made.

1. Said Bohn Corporation agrees to sell, assign, transfer and set over and hereby sells, assigns, transfers and sets over to The Cleveland Trust Company, as Trustee under the Declaration of Trust and Agreement between L. P. Mooers, et al., dated March 7, 1922, the entire right, title and interest in and to the United States Letters Patent No. 1,256,265 and in and to the application for United States Letters Patent, Serial No. 201650, named above, together with the right to sue for past infringements of the said patent or of any patent issuing from such application, and to collect damages and profits arising out of such infringement and apply the same to the benefit of The Cleveland Trust Company, as Trustee.

2. The Trust Company hereby agrees forthwith upon the execution of this agreement to issue and deliver to said Bohn Corporation or its nominees or assigns, fully paid, One Thousand Five Hundred and Twelve and One-half (1512½) shares of the piston patent estate created by the said Trust Agreement dated March 7, 1922, between the Trust Company and L. P. Mooers, et al., there being issued and outstanding at the date of the execution of this agreement Three Thousand (3000) of such shares, exclusive of the One Thousand Five Hundred and Twelve and One-half (1512½) shares so to be issued to said Bohn Corporation or its nominees or assigns.

3. Said Trust Company and said Bohn Corporation agree, forthwith upon the execution hereof, to execute the license agreement, a copy of which is hereto attached.

[fol. 1437] In Witness Whereof, the parties hereto have set their hands and seals to duplicates hereof the day and year first above written.

Bohn Aluminum & Brass Corporation, by P. A. Markey, Vice-President.

Attest: A. P. Lauer, Secretary. (Corporate Seal.)

The Cleveland Trust Company, Trustee, by R. A. Malm, Vice-President.

Attest: A. J. Perfler, Assistant Trust Officer. (Corporate Seal.)

Approved for Execution by The C. T. Co.
R. T. S., Counsel.

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[fol. 1438] **PLAINTIFFS' EXHIBIT NO. 42a**

Franklin Weekly Engineering Report, for the Week Ending October 5, 1918

(Filed January 27, 1934)

Mechanical Laboratory

ML4U—10000 Mile Wear Test

This engine has been built up again and the test has proceeded 8500 miles and will continue on to completion at intervals between our Government work when men are available for attendance.

ML20M—Piston Endurance Runs

Special Long patented aluminum composition pistons. Weight including wrist pin, 2 pressure proof jr. rings, and one Inland top ring—1.225#.

A full set of these pistons were installed in a regular series nine engine and fitted to the cylinders such that the straight skirt clearance from just below the wrist pin down was from .002″ to .003″. The lands were all .025″ clearance just as they were received. It may be noted that there was four oil holes in the top of each wrist pin boss and also eight oil holes just below the lower ring. The engine, thus built up, was placed on dynamometer #2, fitted with tinware as in a car and the test was carried out according to the method described in ML20M so that results are comparable with those in that report.

In this last test the pistons were installed in such a way that the ribless side was toward the exhaust side of the engine.

Result; After 10 minutes running, pistons #4 and 6 seized on the exhaust (ribless) side of the piston.

This test will be repeated with the same style of pistons having a straight skirt clearance of .005″ and having the ribless side of piston toward the suction side of the engine. To build up the motor in this way and not be obliged to cut away the rib in order to make room for the connecting rod cap screw, the connecting rods will be turned through 180° and thus have their cap screw on the suction side.

[fol. 1439] LONG PATENT PISTON—PURCHASE ORDER #35509 —TYPE "B."

250 of these from pattern X-13 are on order at Walker M. Levett Co. To date fourteen of these have been duly received. We are advised that shipment has been made of an additional fifty castings.

Type "A."

One hundred and sixty castings have been received of our original order calling for 350 castings from our type "A" pattern #P-2912. After receiving 65 castings we recalled pattern back from Walker-Levett Co. This to enable bringing pattern up to latest blue print. Upon completion same will be returned them for the completion of our order.

Shipments.

6 Long patent pistons type "A" equipped with rings and wrist pins have been forwarded to our Detroit dealer, Mr. W. J. Doughty.

PLAINTIFFS' EXHIBIT NO. 42b

Franklin Weekly Engineering Report, for the Week Ending July 20, 1918

(Filed January 27, 1934)

ML20N—Piston Endurance Runs

A regular series nine engine was equipped as follows; (a) New production gauge cylinders, (b) #1 cylinder was equipped with Long patent piston with no rib on suction side, (c) other pistons were regular production magnalite having a clearance of .013" for a distance of 1⅛" below the bottom ring and then tapering off to .003" at the skirt.

The engine was then placed on dynamometer #1 and motored in for three hours at 1000 R.P.M. Jackets were installed and a piston endurance run was made under the conditions described in report ML20M.

[fol. 1440] The run proceeded for 19 minutes when the power failed, thus taking the load off the engine. The horsepower had not dropped sufficient to indicate a "set up."

After allowing the engine to cool off to room temperature a second trial was made and this time the run proceeded for 19 minutes when the motor set up suddenly. #1 special piston set up so tightly and there was a large hole in the top of the piston. Two of the other pistons seized slightly on the exhaust side near the skirt.

PLAINTIFFS' EXHIBIT NO. 42c

Franklin Weekly Engineering Report, for the Week Ending May 3, 1919

(Filed January 27, 1934)

MECHANICAL LABORATORY

ML 4X 10000 Mile Wear Test.

The Long Patent pistons with floating wrist pins and straight .003" clearance did not show excessive wear but one piston broke at 75000 miles and the retaining buttons in wrist pin holes had all worked loose, wearing down both the button and the wrist pin hole. One button was broken and one had the horizontal retaining lugs entirely worn away.

The electric welded cylinder did not show any excessive wear nor evidence of failing where it had been welded. This sample was returned to Mr. Babcock.

Practically no carbon was found in spark plug holes where the threads had been undercut.

The valve lifters with same grinding area as S-5 were in good condition after a total of 15000 miles. Some of the lifters showed scarcely any wear from the action of the cams and none showed excessive wear on the lifting surface. Further work will be done along this line. See tables for wear on wrist pins and wrist pin holes in pistons and connecting rods.

(Here follow 2 photolithographs, side folios 1441-1442–1443-1444)

ML4X

PISTON WEAR IN THOUSANDTHS OF AN INCH AFTER 10000 MILES

LONG PATENT PISTONS (A) WITH FLOATING WRIST PINS

No			TOP	BETWEEN 1ST2 RING	BELOW 3RD RING	BELOW WRIST PIN	SKIRT
1	a	No 1 Piston	broke at	7500 miles			
	b						
2	a		1	0	7	4	4
	b		2	.5	6	4	2
3	a		0	0	5	4	3
	b		1	0	3.5	2.5	2.5
4	a		0	0	5	3.5	3.5
	b		3.5	1.5	2.5	.5	1.5
5	a		1	0	6	4	4
	b		4.5	1.5	6	3.5	3
6	a		4	3	9	3.5	4
	b		1	0	1.5	3	4
AVERAGES	a		1.2	.6	6.4	3.8	3.7
	b		2.4	.7	3.9	2.7	2.8

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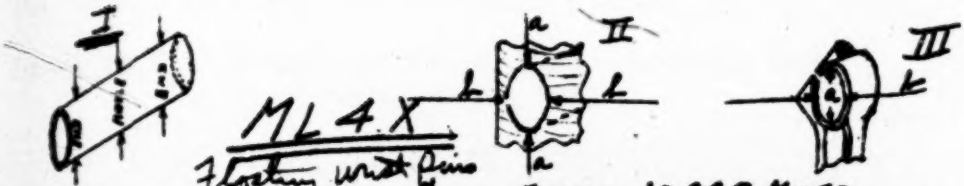

ML 4X

Floating Wrist Pins

WRIST PIN WEAR IN THOUSANDTHS AFTER 10000 MILES

CYL NO.	END	MIDDLE	END
1	Piston Broke at 7500 miles		
2	1	0	1
3	2	.5	2
4	1	0	1
5	1	0	.75
6	1	0	1.5
AVERAGE	1.2	.1	1.25

WEAR IN THOUSANDTHS OF WRIST PIN HOLES IN PISTONS AFTER 10000 MI.

CYL NO.	FRONT "a"	FRONT "b"	REAR "a"	REAR "b"
1				
2	3.5	1.	3.5	1
3	2	1	2	1
4	3	2	2.5	2
5	3	1	3	1
6	2	1.5	2	1.5
AVERAGE	2.7	1.3	2.6	1.3

WEAR IN THOUSANDTHS OF WRIST PIN HOLES IN CONNECTING RODS

CYL NO.	"a" IN LINE WITH ℄ OF PISTON	"b" AT RIGHT ANGLE WITH ℄ ROD
1		
2	0	0
3	.5	0
4	0	0
5	.5	0
6	1	.5
AVERAGE	.4	.1

1443-1444

Tightly Bound

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[fol. 1445] **PLAINTIFFS' EXHIBIT NO. 44**

Letter to E. C. Long from Franklin Manufacturing Company, dated May 9, 1918

(Filed January 27, 1934.)

H. H. Franklin Manufacturing Company, Syracuse, N. Y., U. S. A.

May 9, 1918.

Franklin Motor Cars

Mr. E. C. Long, Hannibal, Mo.

DEAR SIR:

Mr. Franklin has referred your letter of May 6 and preceding one to the writer.

We shall be glad to have you send us one of the sample pistons which you speak of. If more are needed we can arrange with you to supply them or we could have some made up here.

We shall await with considerable interest the arrival of this sample.

Very truly yours, H. H. Franklin Manufacturing Co. R. Murphy, Chief Engineer.

RM/C

[fols. 1446-1450] **PLAINTIFFS' EXHIBIT NO. 45**

Letter to E. C. Long from Franklin Automobile Company, dated April 17, 1918

(Filed January 27, 1934.)

Franklin Automobile Company, Syracuse, N. Y., U. S. A.

Distributors of Franklin Motor Cars

April 17, 1918.

Mr. E. C. Long, Hannibal, Mo.

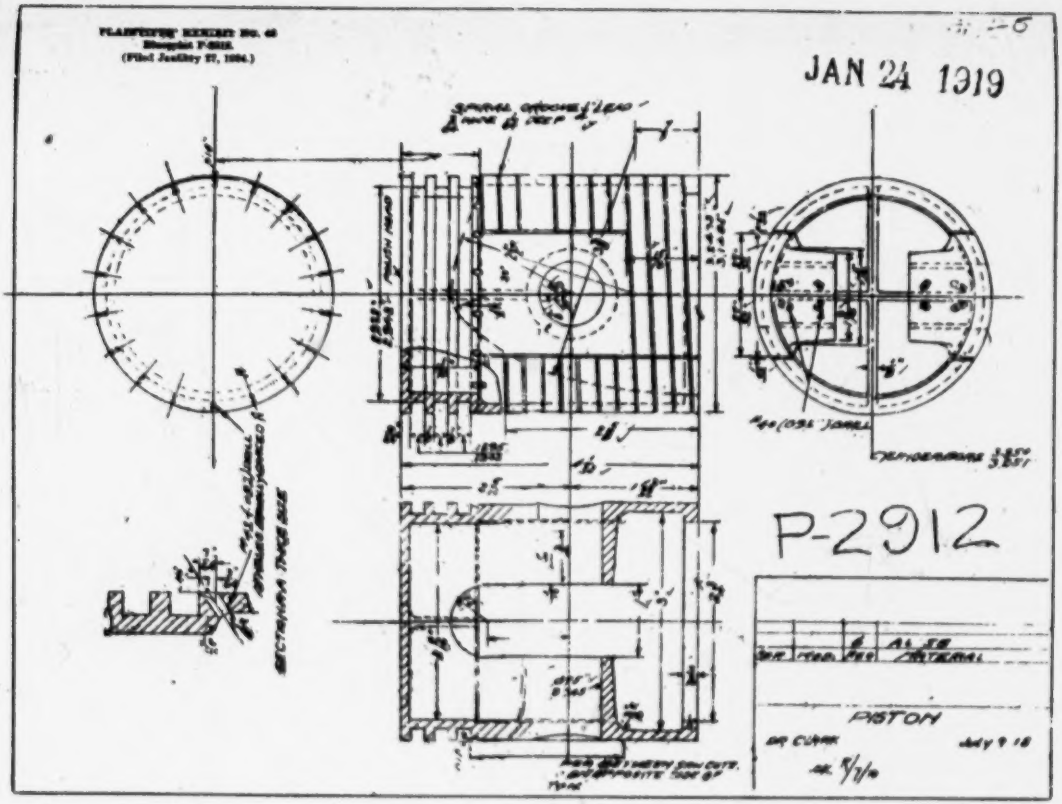
MY DEAR SIR:

I have your letter of April 13 and note with interest that you have a patent piston which shows up well in test. My judgment is that you should arrange to have the piston

tested in some laboratory. There are numerous places where you could have the test made, or we would make it for you. Before going ahead we would want full details of the piston or better still a sample of the piston itself. If the piston is all that you think you could put it on the market or you could license its use by manufacturers.

Yours very truly, H. H. Franklin, President.

(Here follows 1 photolithograph, side folio 1451-1452)


PLAINTIFFS' EXHIBIT No. 46
(Filed January 27, 1924.)
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P-2912
PISTON
1451-1452

6424

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[fols. 1453-1532] **PLAINTIFFS' EXHIBIT NO. 66**

Patent Office List of Applications of Long.

(Filed January 27, 1934.)

(Attorney's Room, Jun 29 1925 U. S. Patent Office.)

(Docket Division Jul 2 1925 U. S. Patent Office)

To the Hon. Commissioner of Patents:

Please permit the H. H. Franklin Manufacturing Company of Syracuse, New York, or its authorized agent or attorney to inspect the files and make copies of the papers therein of each of my pending applications as follows:

Serial Number	Title	Filed
231,786	Case "A"	May, 1919
281,175	Case "D"	March, 1919
304,283	Case "E"	June 14, 1919
317,273	Case "F"	August 13, 1919
339,892	Case "G"	November 22, 1919
375,673	Case "H"	April 22, 1920
437,690	Case "I"	January 17, 1921
432,719	Case "J"	December 23, 1920
522,974	Case "L"	December 17, 1921
602,660	Case "M"	November 22, 1922
624,463	Case "N"	March 12, 1923

Signed at Detroit, State of Michigan, this 13th day of April, 1925.

Long Piston Corporation, Elmer C. Long, President.
Elmer C. Long (Seal)

Witness: Fred G. White.

* * * * * * *

[fols. 1533-1536] **PLAINTIFFS' EXHIBIT NO. 67-B**

Opinion of Examiner in Interference No. 49,569

(Filed January 27, 1934)

Final Hearing March 23, 1928.

In the United States Patent Office

Patent Interference No. 49,569

Hartog v. Long v. Gulick

Pistons

Application of Stephen D. Hartog filed February 16, 1920, No. 359,137.

Applications of Elmer C. Long filed August 13, 1919, No. 317,273; filed March 7, 1919, No. 281,175.

Application of Edward J. Gulick filed November 30, 1917, No. 204,661.

• • • • • • •

[fols. 1537-1584] By agreement of the parties the opinion in this Interference is not included in the Record except for the following quotation taken therefrom:

Long's entire case for priority of conception is in substance based upon the unaided memory of several witnesses speaking about ten years after the event and speaking then with the degree of uncertainty that is inevitable under such circumstances. Long had fifteen to twenty applications for split-skirt pistons on file at the time he was testifying, and had built a great many different forms for which no application was made. (Record, p. 42.) It was thought that no one after a period of many years would be able to recall the particular year when he saw a specific structure of any particular kind of piston from a large number of similar pistons unless there was some special facts that had impressed upon the mind of the witness this particular year and structure. The Long case for priority is fatally defective as to date and identity of the invention of count 2.

There are no facts upon which the examiner of interferences would rule that the Gulick application fails to disclose the inventions defined by the two counts. There is no ade-

quate proof that Long had conceived the invention of either of these counts prior to Gulick's filing date. It is, therefore, held that Gulick is the first inventor of the subject matter of both counts.

Priority of invention of the subject matter in issue is hereby awarded to Edward J. Gulick, the senior party.

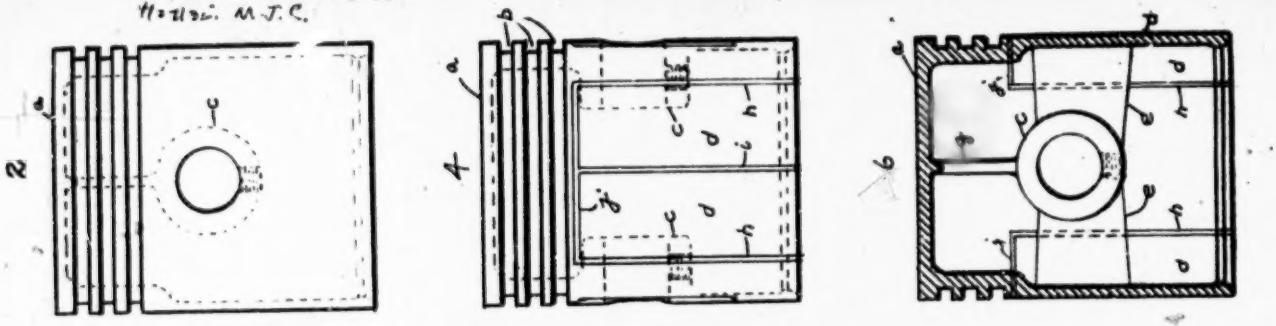
Limit of appeal: August 2, 1928.

H. I. Houston, Examiner of Interferences.

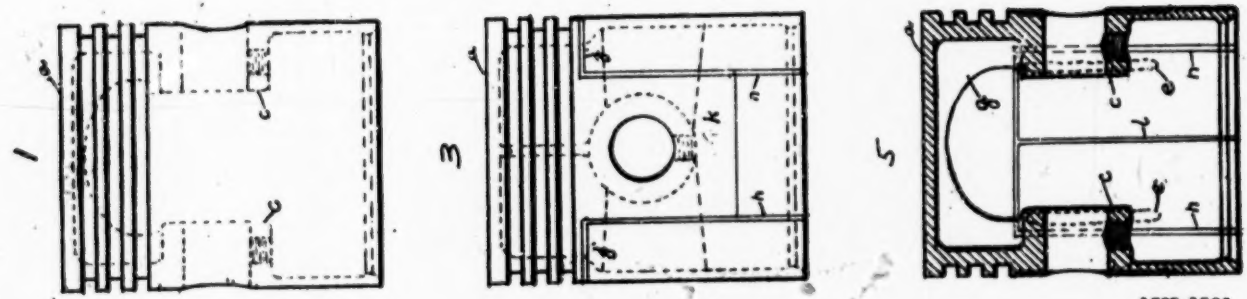
July 2, 1928.

(Here follows 1 photolithograph side folio 1585-1586.)

DEFTS' EXHIBIT A
11-12-26. M.J.C.



DEFENDANTS' EXHIBIT A.
Drawing produced by Venner of Long 1916 Piston.
(Filed January 9, 1933.)



1585-1586

646A

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[fol. 1587] **DEFENDANTS' EXHIBIT C**

Two Paragraphs from Service Department Bulletin, Sheet No. 262, April 8, 1920, of Franklin Automobile Company, entitled "Long Type Pistons"

(Filed January 9, 1933)

4/27/32 M. J. C.

Service Department Bulletin

Sheet No. 262

Long Type Pistons

After April 15 the Service Department will be able to furnish Long Type Pistons in the standard size. These are straight pistons with two to three thousandths clearance. Their weight is approximately the same as the standard piston.

While these pistons have not proved satisfactory in production, we find that they work out very well when used in slightly worn cylinders; cylinders that are not worn more than .005 to .006 inch. If the cylinders are worn more than this they should be rebored. Long Type Pistons will be sold at the same price as the standard piston; viz, $8.50 list, complete with wrist pins, and rings, subject to the regular discount. Oversize, Long Type pistons cannot be furnished.

FRANKLIN AUTOMOBILE COMPANY.

File these sheets.
April 8, 1920.

[fol. 1588] **DEFENDANTS' EXHIBIT D**

Seven Paragraphs from Service Department Bulletin, Sheet No. 289, November 11, 1920, of Franklin Automobile Company, entitled "New Design for Series Nine"

(Filed January 9, 1933)

Service Department Bulletin

Sheet No. 289

New Design for Series Nine

The distinct advantage as a material for pistons which an aluminum alloy with its very light weight and great ability to throw off heat has over cast iron, is conceded by all automobile engineers.

All of the Series 9 cars have been equipped with pistons made from this material and are giving satisfactory service. The Franklin design of these pistons as used in the past has been of the most up-to-date. The one disadvantage connected with their use has been the clearance which has been necessary between the pistons and walls of the cylinders.

Aluminum expands with the application of heat much more than cast iron, and for that reason in the past our pistons have required much more clearance to take care of this feature. This excessive clearance, particularly with a cold motor, has a tendency to make it noisy, to say nothing of affording an opportunity for the escape of gasoline past the rings and into the base, and also allowing an excess amount of oil to work up beyond the rings.

The Franklin engineers, however, realizing the particularly desirable features of the aluminum alloy piston have for the past three years been conducting exhaustive experiments with a view of securing a design such that the undesirable features would be eliminated. That has been accomplished. A new design has been perfected whereby we are now enabled to fit our aluminum pistons with two to three-thousandths clearance. This is the same amount of clearance as would be required for cast iron pistons in Series 9 motors. All motors going through production at this time are being fitted with this new piston known as the Long Piston and a more quiet motor with slightly increased ability is the result.

Fully realizing the fact that with the installation of this Long Piston in Series 9 motors already in service the same improved operation may be obtained to the present owners, [fol. 1589] the Service Department has made the necessary preparations and is in position to supply this same piston in standard size, and can furnish it to you in the .015″ and .030″ oversize to take care of the overhaul work.

This new piston is a distinct improvement. We do not contemplate replacing the earlier type pistons in motors already out, except at owners' expense. Sell it to your owners with that idea in mind.

The price is $6.50 list for piston with wrist pin only.

FRANKLIN AUTOMOBILE COMPANY.

File these sheets.
November 11, 1920.

DEFENDANTS' EXHIBIT H

Article from Franklin Service Bulletin No. 348, April 18, 1932, of Franklin Automobile Company, entitled "The Oval Type Piston"

(Filed January 27, 1934)

Franklin Service Bulletin

"To Reduce the Cost and Improve the Quality of Service"

Franklin Automobile Company, Syracuse, N. Y.

No. 348 April 18, 1922

The Oval Type Piston

A piston which is ground oval in shape and for this reason known as the oval type piston has been going through production in small quantities since last Summer. The results being obtained with this piston are so successful that it may be adopted for standard production. In order to best understand what the oval type piston is it is necessary to [fol. 1590] know some of its specifications:

	Oval Type	Long Type
Length of piston	4"	4- 1/16"
Length of piston skirt	2-13/16"	2-31/32"
Length of piston above wrist pin	2⅜"	2-15/32"
Circumference of piston	oval	round
Shape of piston	tapered	straight
Clearance at the diameter perpendicular to wrist pin		
At bottom of skirt	.003	.005
At top of skirt	.005	.005
Clearance in line with wrist pin		
At bottom of skirt	.012	.005
At top of skirt	.014	.005

The oval type piston has several advantages over the straight and round type of piston. Principal among them are:

1. The oval piston has a clearance of only .003 to .005 of an inch over a distance of 1¼ inches on each side of the piston at the diameter perpendicular to the wrist pin. This gives the oval piston the advantage of a close fit, but the tendency for tightening of the piston of the wrist pin due

to friction between the cylinder and piston is avoided because of the much greater clearance at all other points.

2. The increased size of the combustion chamber due to the oval piston being 3/32 of an inch shorter from the center line of the wrist pin to the top of the piston reduces the tendency for pinging.

[fol. 1591] **DEFENDANTS' EXHIBIT I**

Article from Page 1, Franklin Service Bulletin No. 369, Feb. 20, 1923, of Franklin Automobile Company, Entitled Piston and Wrist Pin Knocks, and Drawing on Page 2, Entitled "Drill Jig for Extra Oil Holes in Piston"

(Filed January 3, 1933)

4/27/32 M. J. C.

Franklin Service Bulletin

"To Reduce the Cost and Improve the Quality of Service"

Franklin Automobile Company, Syracuse, N. Y.

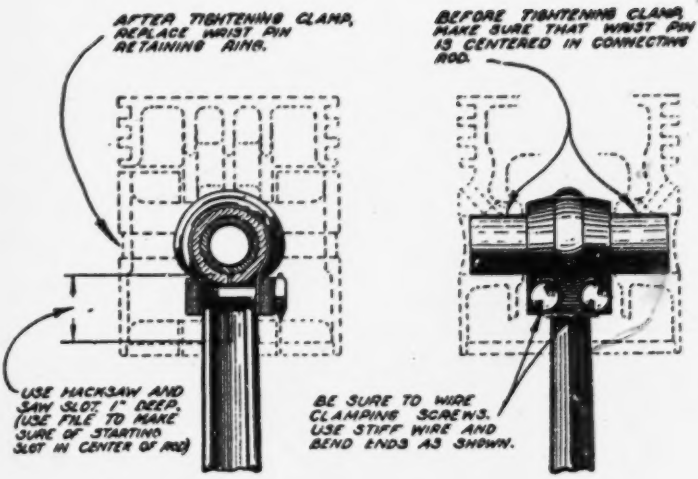
Piston and Wrist Pin Knocks

For those dealers who have trouble in distinguishing a piston slap from a knock made by a loose wrist pin, the following descriptions will be helpful.

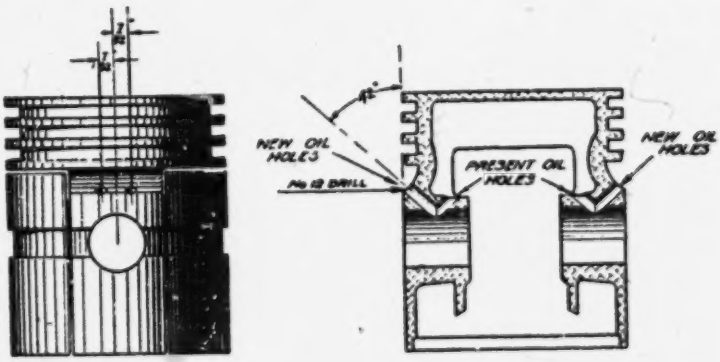
Piston Slaps.—There are two characteristic piston noises, one known as a "slap" and the other as a "ping." A slap is more noticeable when the engine is cold and tends to disappear when the engine is hot. A "ping" does not appear until the engine is hot. A slap gives a much sharper noise than a ping, and since a slap usually appears in but one cylinder, it is of less frequency than a ping. A constant application of power at a moderate speed, such as going up a slight incline at 18 or 20 miles an hour with a cool engine, will bring out a slap more distinctly than anything else.

Wrist Pin Knocks.—Worn wrist pins cause a slight but distinct double knock that is heard only at low speed, and which becomes more distinct as the engine warms up. It is not so sharp as a piston slap and can be easily heard when the engine is throttled down to a slow idling speed. A wrist pin knock from a particular cylinder disappears if the compression is relieved by removing the spark plug.

(Here follow 2 photolithographs, side folios 1592—1593-1594)



INSTALLATION OF WRIST PIN CLAMP.



LOCATION OF NEW OIL HOLES IN SERIES 10 PISTON.

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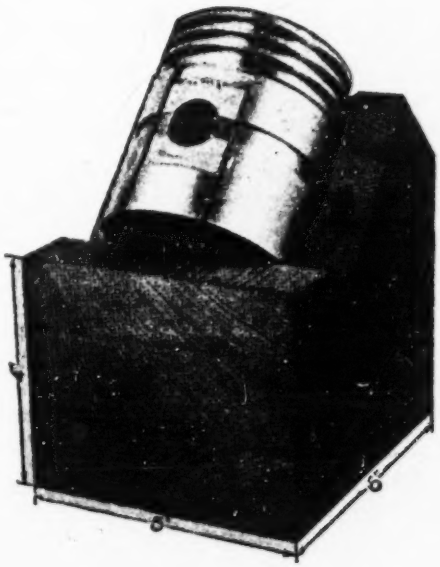
Defendants' Exhibit I, Re Piston and Wrist Pin Knocks



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[fol. 1595] **DEFENDANTS' EXHIBIT J**

Forfeited and Abandoned Application of William M. Venner for Improvement in Pistons, filed April 12, 1920, Serial Number 373,340

(Filed January 27, 1934)

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DEPARTMENT OF COMMERCE

UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

This is to Certify that the annexed is a true copy from the records of this office of the Petition, Specification, Oath and Drawing, as originally filed, in the matter of the Forfeited and Abandoned Application of William M. Venner, filed April 12, 1920, Serial Number 373,340, for Improvement in Pistons.

In Testimony Whereof I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this sixteenth day of September, in the year of our Lord one thousand nine hundred and thirty-one and of the Independence of the United States of America the one hundred and fifty-sixth.

THOMAS E. ROBERTSON,
Commissioner of Patents.

(Seal.)

Attest:
D. E. WILSON,
Chief of Division.

(Mail Room Apr 12 1920 U. S. Patent Office)

(U. S. I. R. Documentary Stamp 25 Cents)

Application for U. S. Letters Patent

PETITION.

To the Commissioner of Patents:

Your petitioner, William M. Venner, a citizen of the United States, residing at South Bend, in the County of St. Joseph and State of Indiana, and whose post-office address is 316 Hamden Court, in said city, prays that Letters Pat-

[fol. 1596] ent may be granted to him for the improvement in Pistons set forth in the annexed Specification.

And I hereby appoint George J. Oltsch, 711-12 Studebaker Building, South Bend, Indiana, U. S. A., Register No. 9371, Attorney, with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to sign my name to the drawings, to receive the Letters Patent, and to transact all business in the United States Patent Office connected therewith.

Signed at South Bend, in the county of St. Joseph and State of Indiana, this 8th day of April, 1920.

☞ (Sign here
First name in Full.)

WILLIAM M. VENNER.

SPECIFICATION.

To All Whom it May Concern:

Be it Known, That I, William M. Venner, a citizen of the United States, residing at South Bend, in the County of St. Joseph, and State of Indiana, have invented certain new and useful inprovements in Pistons, of which the following is a specification:

373340—1

The invention relates to pistons and has for its object to provide a piston especially adapted for use in air cooled internal combustion engines, and to provide a piston so constructed that the use of aluminum and other light metals may be accomplished, thereby giving lightness of reciprocating parts, which metals have a greater relative degree of expansibility than the cylinder casings under the same temperature. Pistons of aluminum and alloys on account of their relative greater degrees of expansibility than the cylinder casings tend to seize the cylinders under high temperatures unless considerable clearance is provided and too much clearance is impractical, as the pistons will slap under low temperature, therefore it is the primary object of the invention to provide a skirt for the piston formed in sections, which sections are supported by downwardly extending webs, which webs are spaced apart at their bottoms and so constructed that they will have a relatively narrow width in proportion to their length so that the expansion of the webs will be more in the direction of their length than width. The lengthwise expansion being un-

[fol. 1597] limited thereby the web supported skirt sections will not seize the cylinder.

With the above and other objects in view the invention resides in the combination and arrangement of parts as hereinafter set forth, shown in the drawings, described and claimed, it being understood that changes in the precise embodiment of the invention may be made within

2 373340—2

the scope of what is claimed without departing from the spirit of the invention.

In the drawings:—

Fig. 1 is a side elevation of the piston.

Figure 2 is a vertical sectional view taken on line 2—2 of Figure 1.

Figure 3 is a horizontal sectional view taken on line 3—3 of Figure 2.

Referring to the drawings, the numeral 1 designates a piston and 2 the head thereof. The head 2 is provided with a plurality of piston ring grooves 3 for the reception of piston rings of any conventional form. The piston is made from aluminum or any other light metals, or from any metal which has a greater expansibility than the cylinders in which it may be used. Pistons of this character in the past, on account of their greater expansibility than the cylinders [on]* in which they are used have been found, when subjected to extreme temperatures, to bind or seize the bore of the cylinders, and where sufficient clearance has been allowed in the skirt of the piston under low temperatures the piston slaps. To overcome the above object the skirt 4 of the piston is slit as at 5 and 6 so as to form skirt sections 7, which sections form a major area entirely separated from the remaining wall sections 8 of the skirt 4. The adjacent edges of the skirt sections so formed being spaced from each other so as to allow independent movement when the piston is subjected to high or low temperatures.

The head 2 of the piston is provided with a chamber

3 373340—3

9 and depending downwardly from said chamber and integrally connected to the head 2 are webs 11 and 12. Webs

[*Matter enclosed in brackets struck out in copy.]

11 extend downwardly and are integrally connected to the skirt sections 8 and merge into bearings 13 for the wrist pin. The webs 12 extend downwardly and outwardly and are of greater length than width and have integrally con- [fol. 1598] nected to their ends the skirt sections 7. It will be seen that by having the web sections 12, independent of each other and of greater length than width, that when the piston is subjected to high temperatures the expansion of the webs will be more in the direction of their length than in the direction of their width and that the length-wise expansion may be of any degree without causing the skirt to seize the cylinder. It will also be seen that by having the major area of the skirt in the skirt sections 7 which are entirely separated from the remaining skirt portions 8 and the major area sections 7 being supported entirely by the elongated webs 12 integrally formed with the head 2 of the piston, that the expansion will be longitudinally and not laterally, thereby maintaining a snug fit of the piston as a whole during high or low temperatures so as to overcome the difficulty at present experienced where pistons are made of aluminum or other metals, which have a greater expansibility than the cylinder. By providing supporting webs for the skirt sections, which webs are of greater length than width so that expansion of the webs will be lengthwise, the difficulty heretofore experienced in split skirts for pistons is obviated.

The invention having been set forth what is claimed as new and useful is:—

1 The combination with a piston head, of a skirt therefor, said skirt being formed from independent sections, and webs carried by the piston head and supporting the independent sections, said webs being of greater length than width, thereby insuring longitudinal expansion and contraction.

2 The combination with a piston head, of a skirt therefor, said skirt being formed in sections, some of said sections being carried by the piston head, the other sections being independent, the independent sections being supported by webs carried by the piston head, said webs being of

greater length than width so that they will expand and contract longitudinally.

3 The combination with a piston head, of a skirt therefor, said skirt being formed in sections, some of said sections being integrally connected to the piston head, the other sections being independent of the piston head, and downwardly extending webs carried by the piston head and supporting the independent sections, said webs being of greater length than width, thereby causing longitudinal ex- [fol. 1599] pansion of the webs when subjected to heat.

4 The combination with a piston head, of a skirt therefor, said skirt being formed in sections, some of said sections being carried by and integrally joined to the piston head, the other sections being independent of the piston head, downwardly and outwardly extending webs carried by the piston head and supporting the independent sections, said webs being of greater length than width so as to insure longitudinal expansion and contraction.

373340—5

5 The combination with a piston head, of a skirt therefor, said skirt being formed in sections, some of said sections being carried by the piston head, the other sections being independently supported in relation to the piston head, webs carried by the piston head and supporting the independent sections, said independent sections comprising the major area of the skirt, said webs being of greater length than width thereby insuring longitudinal expansion and contraction.

6 The combination with the head of a piston, of a skirt therefor, said skirt being formed in sections, some of said sections being integrally connected to the piston head, the other sections being independent of the piston head, said independent sections comprising the major area of the skirt, and downwardly extending independent webs for supporting the independent sections, said webs being of greater length than width, thereby insuring longitudinal expansion and contraction.

373340—6

In Testimony Whereof I affix my signature.

William M. Venner.

(Sign here First name in Full.)

OATH

State of Indiana,
County of St. Joseph, ss:

William M. Venner, the above-named petitioner, being duly sworn, deposes and says that he is a citizen of (1) the United States, and resident of South Bend, Indiana; that he verily believes himself to be the original, first, and (2) sole inventor of the improvements in Pistons described and [fol. 1600] claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application, or in public use or on sale in the United States for more than two years prior to this application; that said invention has not been patented in any country foreign to the United States on an application filed by him or his legal representatives or assigns more than twelve months prior to this application; and that no application for patent on said improvement has been filed by him or his representatives or assigns in any country foreign to the United States.

☞ (Sign here
First name in Full.) William M. Venner.

Sworn to and subscribed before me this **8th** day of April, 1920.

Orlo R. Deahl, (Official Signature), Notary Public, (Official Character). (Notarial Seal)

[Seal here, to be impressed in paper.]
My commission expires **Mar. 30, 1921.**

☞ Note.—Acknowledgment should be made before a Notary Public, *who must affix his seal.* If executed before an officer not provided with a seal, the Certificate of the Judge or Clerk of County Court must be affixed, showing official character of such officer.

373340—7

(Here follow 2 photolithographs, side folios 1601-1602—1603-1604)

293/62

Fig. 1.

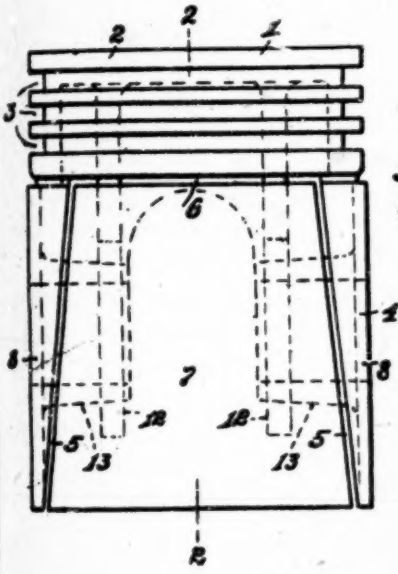


Fig. 2.

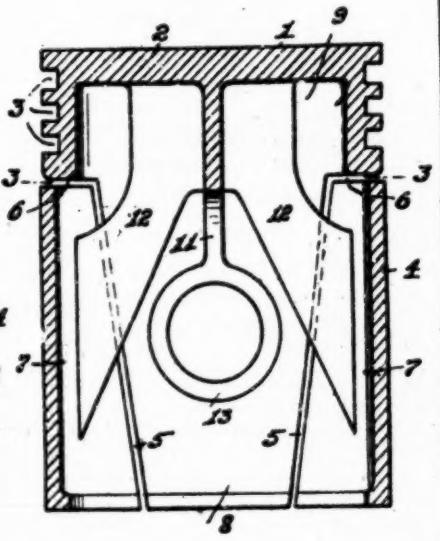
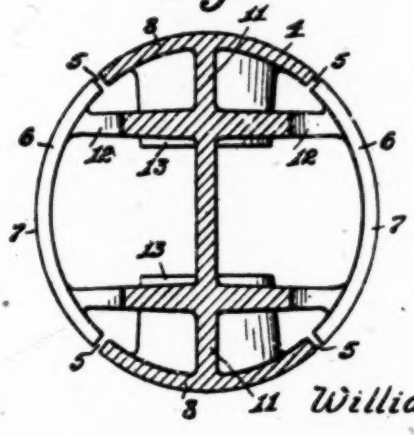


Fig. 3.



William M. Venner
INVENTOR

By George F. Otto
ATTORNEY.

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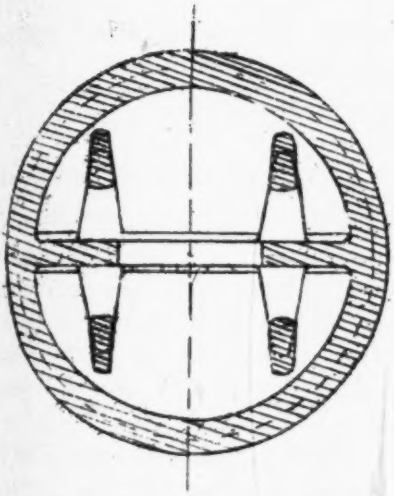
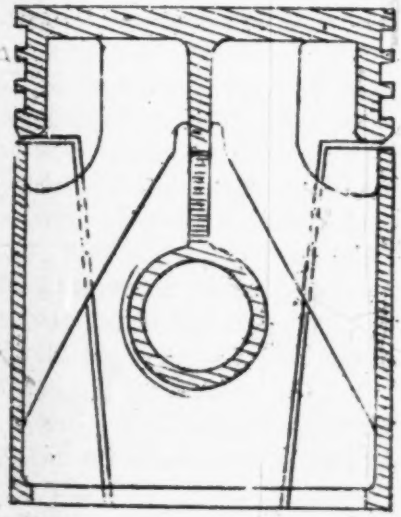
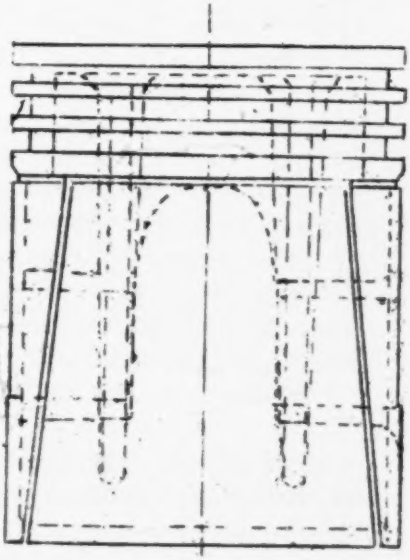
DEFTS' EXHIBIT K
4/27/32 M.J.C.



DEFENDANTS' EXHIBIT K.
Venner Drawing, February 16, 1920.
(Filed January 27, 1934.)





W.M. VENNER
SOUTH BEND, IND.

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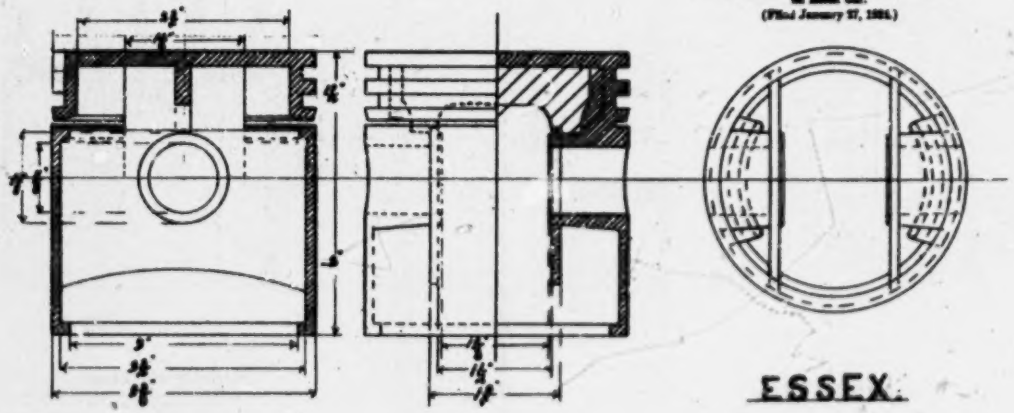
DEFENDANTS' EXHIBIT T-6
Tracing produced by Chadwick of Long Pistons for
an Essex Car.
(Filed January 27, 1926.)



ESSEX.

1617-1618

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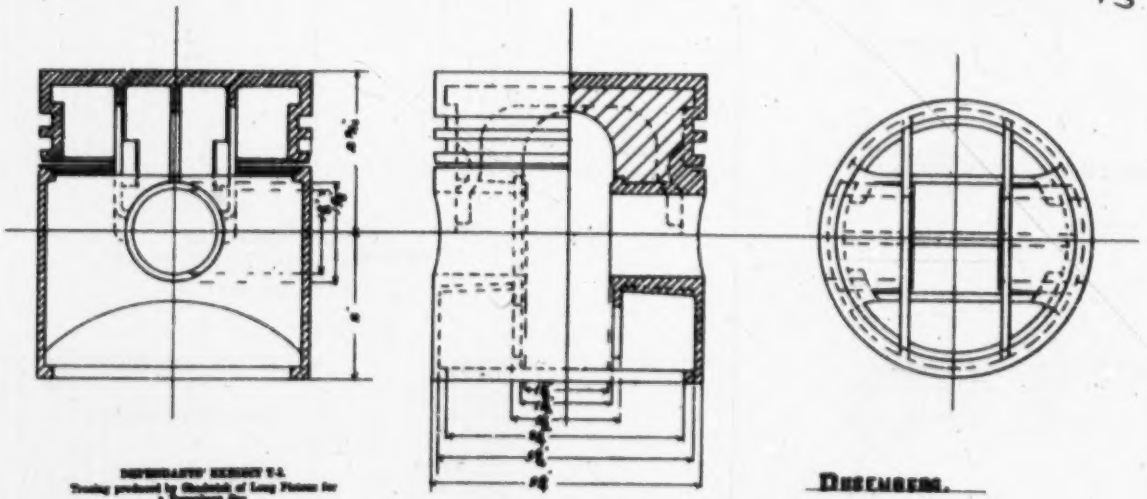
T3



DEFENDANT'S EXHIBIT T-3.
Tracing produced by Chadwick of Long Pictures for
a Rosenberg Bro.
(Filed January 17, 1924.)

DISTRICT.

1619-1622

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[fols. 1605-1608] **DEFENDANTS' EXHIBIT L**

Letter from George J. Oltsch to Wm. M. Venner, Dated September 22, 1920

(Filed January 27, 1934)

Sept. 22, 1920.

Mr. Wm. M. Venner, 2217 Locust St., St. Louis, Mo.

DEAR SIR:

In the matter of your application for a patent on Piston, I am this day in receipt of a communication from the Patent Office advising that all of the claims as originally filed are deemed to be allowable with the exception of one claim, which leaves five allowable claims.

Claim 1 was rejected on British patent to Ricardo, No. 17,953, dated Dec. 23, 1915. Until I receive a copy of this patent, which has been ordered, I will not be able to determine as to the pertinency of said reference. Whether or not said claim is justly allowable, the allowed claims will afford you very good protection. The rejected claim was not limited in scope to a piston having a skirt portion made up of sections supported by webs extending from the head portion of the piston, while the allowed claims are limited to some of said sections being integrally formed with the head, and other independently supported by webs extending from the head. The latter as covered by your allowed claims appears to be the most practicable construction, and, if such should be the case, the claims allowed you will afford you ample protection.

I will take further action as soon as copy of the Ricardo patent comes to hand, and in the meantime you should decide whether you desire any foreign patents, and whether you desire an infringement search made, in order to be on the safe side, if you intend to market the piston. I am very much pleased to be able to submit such a favorable report.

Very truly yours.

[fol. 1609] **DEFENDANTS' EXHIBIT N**

Article from Pages 8 and 9 of Manual for Trouble Shooters of Franklin Automobile Company, entitled "Piston Slap"

(Filed January 27, 1934)

PISTON SLAP

A slap is more noticeable when the engine is cold and tends to disappear when the engine is hot. It gives a much sharper noise than a "ping" and since a slap usually

appears in but one cylinder, it is of less frequency than a ping. A constant application of power at a moderate speed, such as going up a slight incline at 18 or 20 miles an hour with a cool engine, will bring out a slap more distinctly than anything else.

Slaps are due to the clearance allowed between the piston and the cylinder walls. A certain amount of clearance is necessary to take care of the expansion of the heated piston. (A piston gets hotter and expands more than a cylinder.) Aluminum pistons expand more than cast-iron or steel ones and since this extra expansion requires more clearance, they are more apt to slap. A slap that disappears after an engine is warmed up can do no harm and it is a waste of money to try to eliminate it. Often when such a slap is removed from one cylinder it will appear in another.

Three types of pistons have been used in Series 9 and 10 engines, "tapered," "straight," and "oval." The proper clearances for these are as follows:

Piston	Clearance at top of skirt	Clearance at Bottom of skirt
Tapered	.008″	.003″
Straight	.005″	.005″
Oval	.005″	.003″

The original clearance of a piston and cylinder is given by the figures stamped on the head of the piston and on the bottom of the cylinder flange.

To determine which piston is slapping, run the engine at the speed at which the slap is most noticeable and then short circuit the spark plugs one at a time with a screw-driver. When the slapping cylinder is short circuited, the slap will be much less noticeable or will disappear entirely. Another method of locating a slap is to have the engine idling and then to open the throttle in short, sudden jabs, feeling each cylinder with the point of a small [fol. 1610] screw-driver held just under the cooling fins as this is done. A distinct tap can be felt on the slapping cylinder. Another method is to use a long screw-driver as a "listening rod," placing the blade of the screw-driver against the cylinder and the handle against the ear. [The only remedy for a slapping piston is to install a larger piston or a smaller cylinder. If the cylinder should be too badly worn (over .005″) to install a new piston, the cylinder can be reground by the factory for a nominal charge and an oversize piston installed.]

1611-1612

SPECIMEN SHEET 0.
Drawing prepared by Chadwick, Long & Eliot Patents.
(Filed January 27, 1894.)

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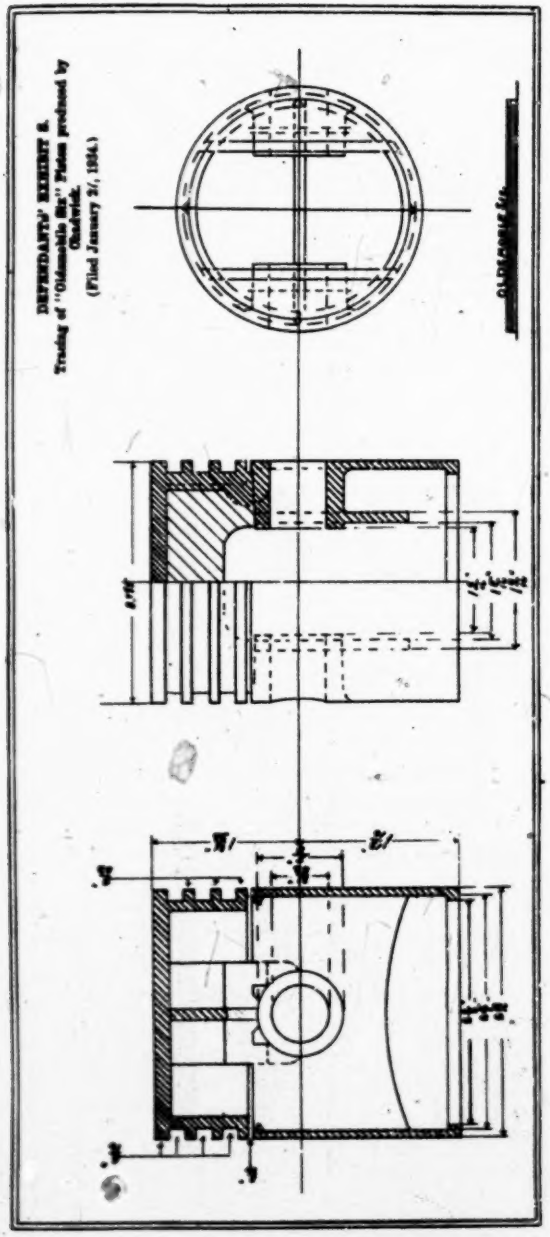
DEFENDANTS' EXHIBIT A.
Tracing of "Oldsmobile Six" Piston produced by Oldwield.
(Filed January 2/, 1934.)
1613-1614

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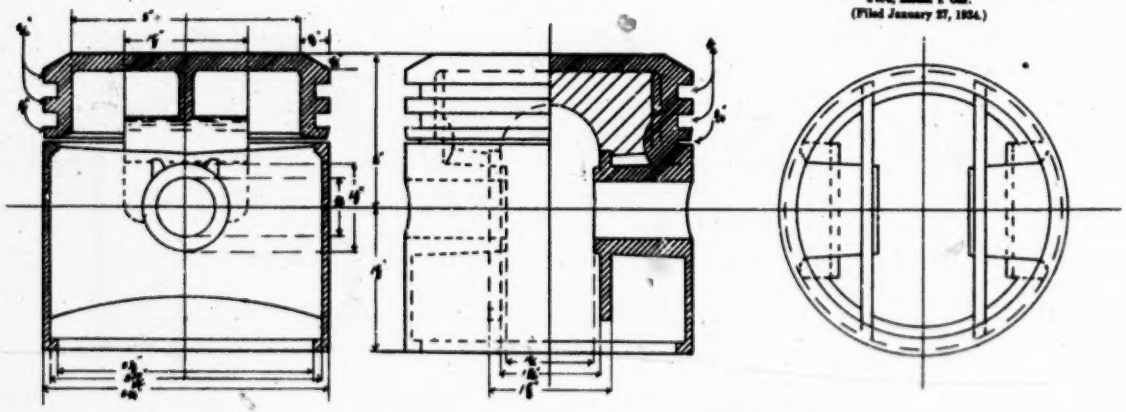
DEFENDANTS' EXHIBIT T-1.
Tracing produced by Chadwick of Long Plaines for Ford, Model T Car.
(Filed January 27, 1934.)



FORD

1615-1616

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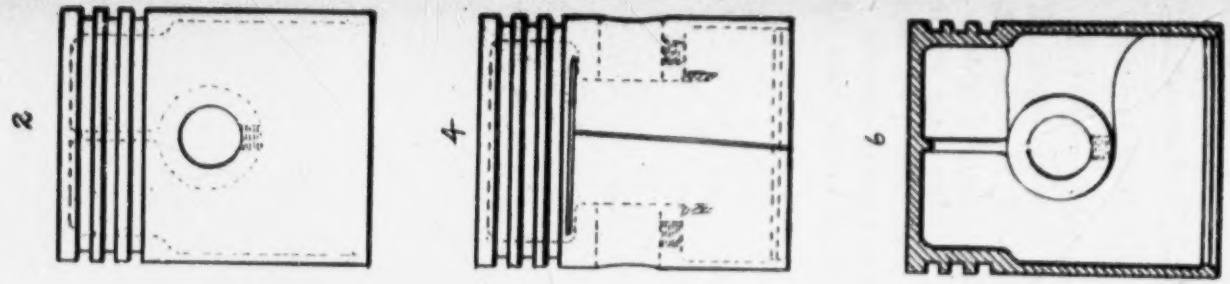
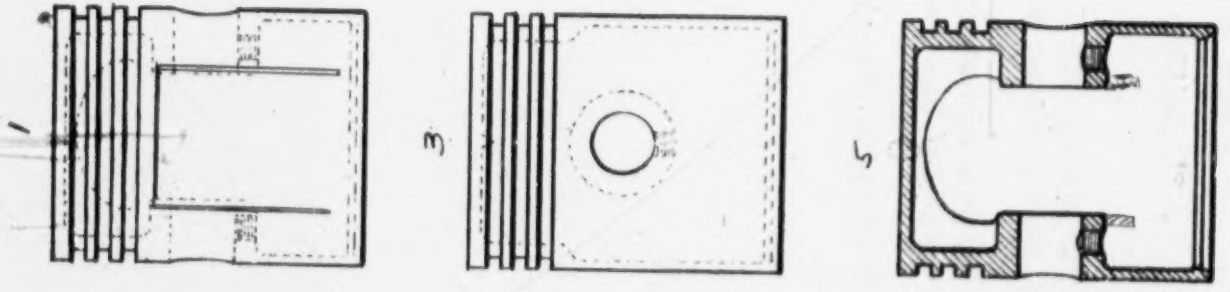


DEFENDANTS' EXHIBIT W.
Photostat of Trunk Piston added to by Chadwick to show T-slot Long Piston.
(Filed January 27, 1904.)



1623-1624

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[fols. 1625-1626] **DEFENDANTS' EXHIBIT X**

Digest of Defendants' Exhibit X

Agreement, dated September 20, 1919.

Between E. C. Long and M. K. Weems.

Subject Matter:

E. C. Long business at 1037 and 1039 Main Street, Quincy, Ill., together with certain named machines, tools, supplies, etc. sold to M. K. Weems for $45,000.00.

Long licensed Weems to manufacture and sell pistons under each patent owned by Long and each Long application for patent then on file.

Weems agreed to pay Long a royalty of twenty (20) cents for each piston made or sold.

(Here follows 1 photolithograph, side folio 1627-1628)

1627-1628

DEFENDANTS' EXHIBIT T.
Photostat of Drawing by Sullivan, Long 1916 Piston.
(Filed January 27, 1934.)

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[fol. 1629] **DEFENDANTS' EXHIBIT Z**

L. M. Stellman's Report, dated March 18, 1919, entitled "Test on Long Pistons"

(Filed January 27, 1934)

March 18, 1919.

Z/RM

(Docket Division Dec. 23, 1927, U. S. Patent Office)

TEST ON LONG PISTONS

Mr. Long, our dealer in Quincy, Ill., was out here with a new design of aluminum piston for our motor in connection with which he has had four claims allowed by the Patent Office. Several tests have been run in connection with this piston; the first being a set-up test on the block with baffle plates under the cylinders which did not give a sufficient amount of oil so but what a set-up was obtained in about nine minutes. This was a more severe test than we ordinarily give our regular production piston such as we are now using, and it is doubtful even if the pistons were undercut as we recommend them to be for use in the southwest would stand up under this test any longer than these pistons did. There was also a tendency toward too little oil. After this test, we decided to put these pistons on the road in a motor and consequently Mr. Long and the writer started out with a sedan equipped with new pistons, new rings and new cylinders which had never been run in together, the pistons having oil grooves cut circumferentially so as to give the pistons **and** [in]* cylinder wall a little more oil than we had on the set-up test. These pistons and cylinders were placed on sedan demonstrator motor with spark plug holes undercut as regards to the threads, as per latest experiments, so as to cut down pre-ignition as much as possible, with which we have recently had trouble on production cars.

We carried four people and luggage, leaving Syracuse at 2:30 p. m., making Utica in an hour and twenty minutes, although it was scarcely possible to get over 40 miles an hour on the level with the car, due probably to the fact that neither the rings nor the pistons were run in at all. Power gradually improved although it was a very severe test to

[* Matter enclosed in brackets struck out in copy.]

take a green motor and drive from Syracuse to Utica in an hour and twenty minutes. Also made the run from Syracuse to Albany in 4 hours and one-half, driving from Syracuse to Poughkeepsie in 6¾ hours of running time. This is [fol. 1630] a mileage of about 240 miles. During this comparatively high speed, the car got so it would hold 45 miles on the level continuously. One quart of oil was consumed in the total 240 miles. This oil consumption is very low, considering the speed which the car made. It has been the writer's experience that a normal production car would consume approximately one gallon of oil under the same conditions.

The run was continued to New York the next day where a day was spent at the Aeronautical Show. The next morning the oil was drawn off from the engine base, washed out, new oil put in, and we left Columbus Circle at 9 a. m., driving up through Connecticut, through Bridgeport, New Haven to Hartford, making 125 miles in 3½ hours. On this run, there was considerable comparatively level straight road and the car would hold 50 miles an hour against a slight head wind. During this run the Franklin kept ahead of a Cadillac coupe which was evidently bent on beating us to Hartford. After reaching Hartford, it was decided that it was practically impossible to set this car up under normal conditions on the level under temperatures encountered which were fairly cool, even though hot air was used both on suction yoke manifold and carburetor intake. Therefore we decided to take the car up into the Vermont hills through mud roads. We drove the car 120 miles on low and second gear work over roads that were axle deep with mud, so deep that we scraped the flywheel boot off. While it was possible to get the motor to pre-ignite so that the engine would lose power badly and it would be necessary to drop into a lower gear; as soon as this was done, the engine speed was allowed to pick up, pre-ignition would disappear and the motor would run apparently in excellent shape. With regular production motor or cast iron pistons if pre-ignition was obtained as it was in this car, the motor would, in the writer's opinion set up when shifted to lower gear and speed increased. During this 120 mile drive in the mud, sedan was carrying one thousand pounds dead load. The remainder of the trip was completed back to Syracuse over the Mohawk trail, coming up the long grade on the east side of Hoosick Mountain with about 3" of soft snow. The whole

grade was negotiated in second gear except when the pre-ignition got so great that it was necessary to drop into low gear for a short period of time. The last 150 miles was run in 4¼ hours running time. The total oil consumption from the time we left New York, during all our low and second [fol. 1631] gear and hard work, was at the rate of 680 miles to the gallon.

From this test it would look as if it might be desirable to change the baffle plates slightly from those used on this motor so as to allow the motor to use more oil at low speeds. The gasoline consumption for the total 970 miles averaged 15 miles to the gallon which would seem to be very good considering the speed and the condition of the roads. It seems to the writer as if this piston was operating satisfactorily and would run in a perfectly satisfactory manner. The only question would be as to how the performance in regard to pre-ignition and loss of power would be in the southwest where the temperatures encountered are considerably higher. On examining the pistons after the motor was torn down, there was no trouble encountered with scores or roughness on the piston, but the cylinders were slightly scored in a vertical direction. This probably was due to starting the motor out and running under extremely hard conditions without first running pistons and cylinders together.

L. M. STELLMAN.

[fol. 1632] **DEFENDANTS' EXHIBIT AA**

Digest of Defendants' Exhibit AA

License Agreement, dated March 20th, 1919.

Between Elmer C. Long of Quincy, Illinois, and the H. H. Franklin Manufacturing Company, of Syracuse, New York.

Subject Matter:

Elmer C. Long grants a non-exclusive license to the Franklin Company under Long Application for Patent, Serial No. 281,175 and under all patents and applications owned or thereafter acquired by Long.

The Franklin Company agrees to pay Long a royalty of twenty (20) cents for each of the first thirty thousand (30,000) pistons made and sold, fifteen (15) cents for each of the next thirty thousand (30,000) pistons made and sold, and ten (10) cents for each piston made and sold thereafter.

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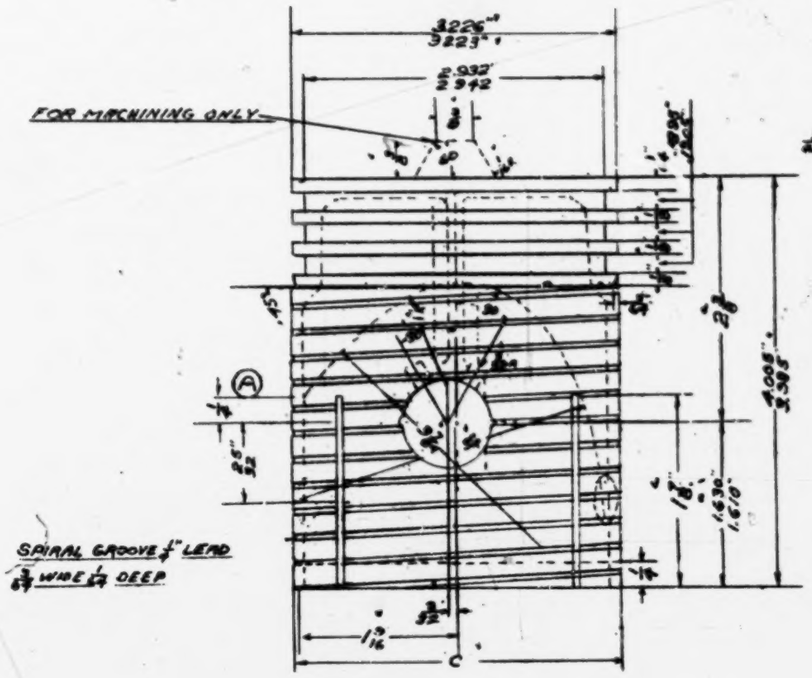
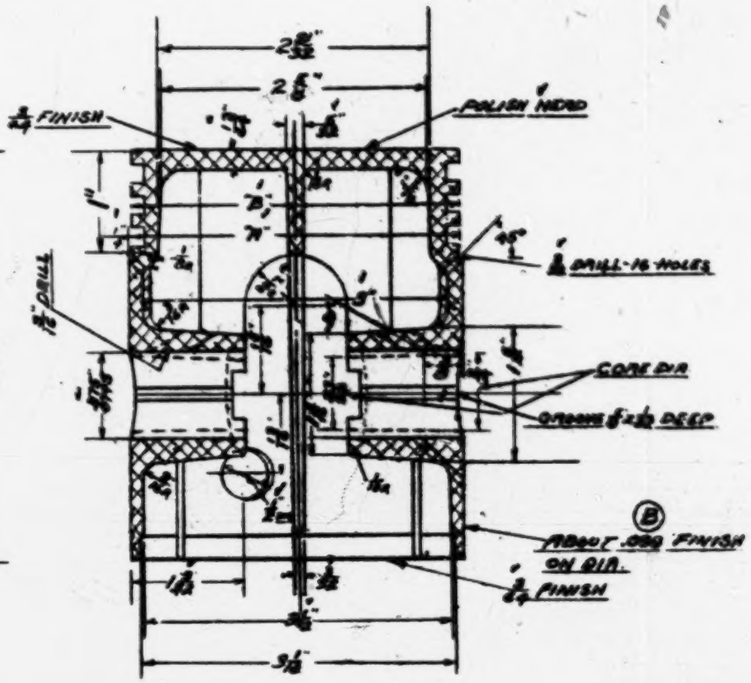
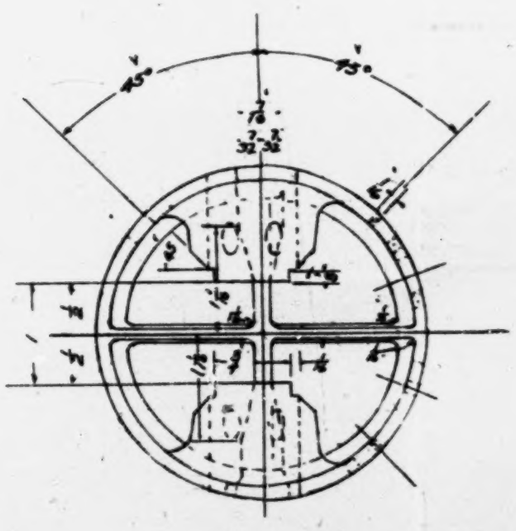






GRIND PISTON A" OF SUCH SIZE THAT WHEN ASSEMBLED WITH CYLINDER CLEARANCE WILL BE .018"
CAMP'B" WITH .01 CLEARANCE TAPERING TO .002" AT "C".
NOTE CYLINDER BORE
ALL PISTONS ON SAME MOTOR MUST BE SAME WEIGHT

HEAT TREATED AND BRINELL 601-10

DEFENDANTS' EXHIBIT CC (1).
Blueprint D-793X of The Aluminum Castings Co. (Drawing of Proposed Design of Piston for H. H. Franklin Mfg. Co.
(Filed January 27, 1934.)

122-5

REVISIONS	A	B	C	D	E	F	G
PREVIOUS		064					
CHANGED							
TO		.033					
SEE							

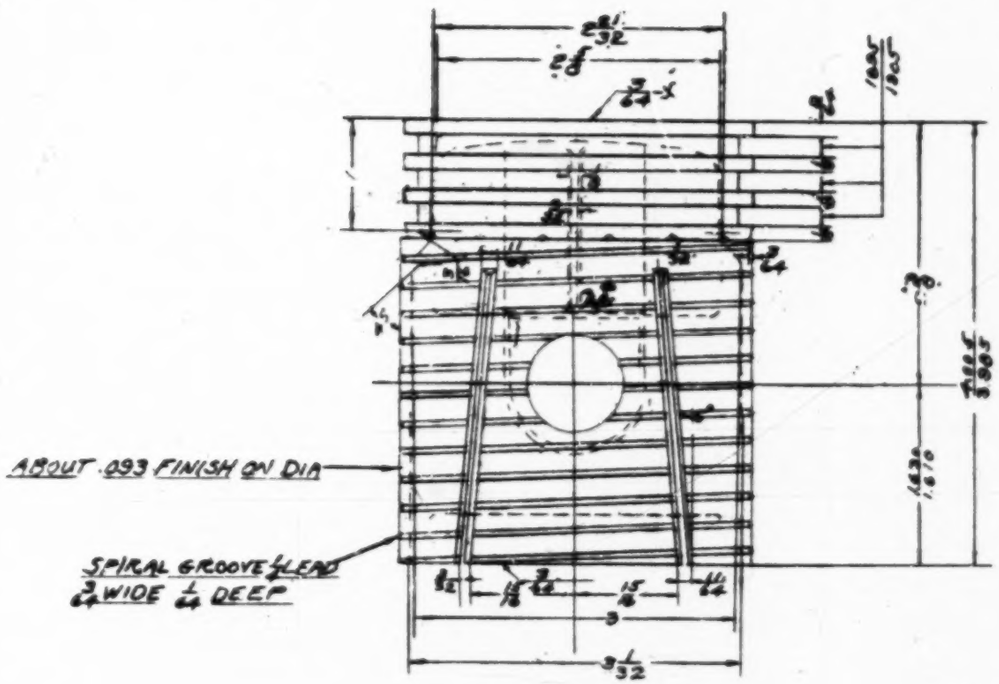
—NOTE—
DO NOT SCALE THIS BLUEPRINT
TOLERANCES ON ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED

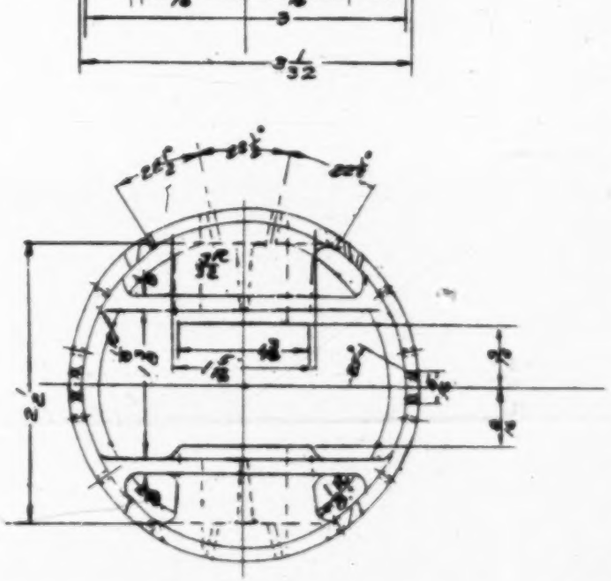
DATE FEB 14 1930
ROUGH WEIGHT
DESIGNED BY
DRAWN BY C.H.T.
APPROVED

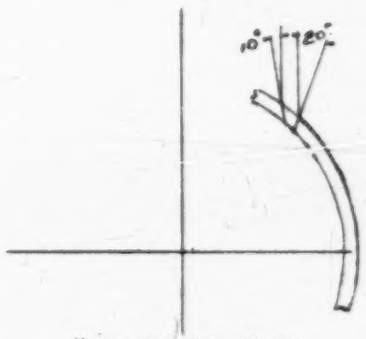
SCALE 1"=1"
FINISHED WEIGHT
MATERIAL LYNITE-ALLOY
CHECKED BY

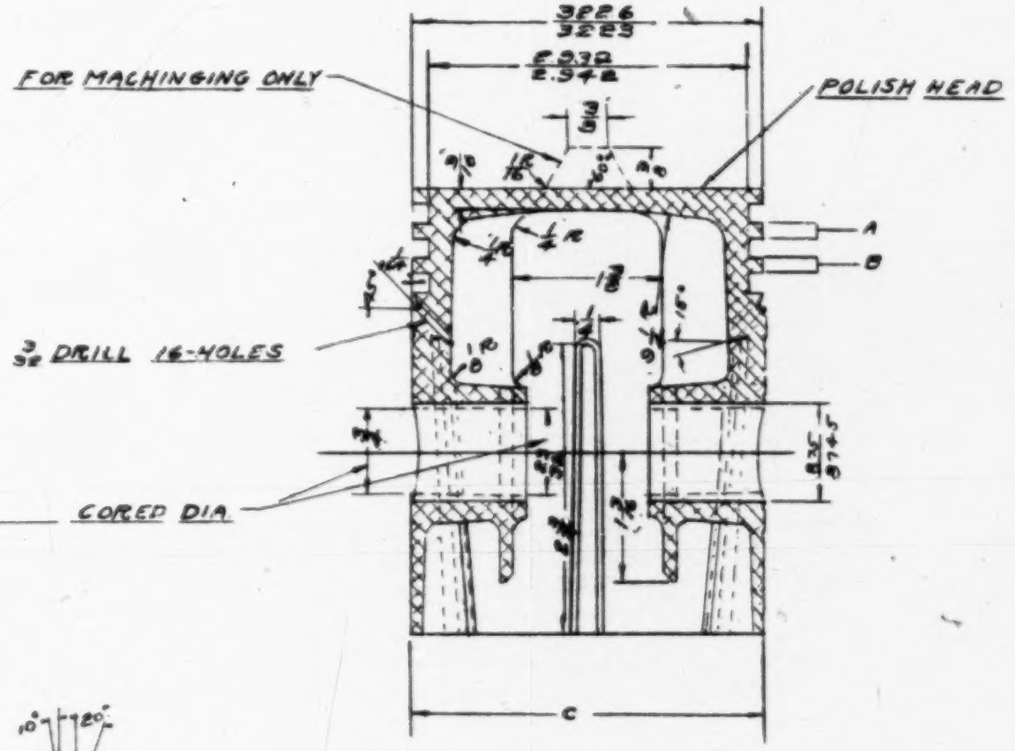
THE ALUMINUM CASTINGS CO.
CLEVELAND, OHIO
DRAWING OF
PROPOSED DESIGN OF PISTON
FOR H.H. FRANKLIN MFG. CO.
SYRACUSE, N.Y.
PLANT N
D-793X

1633









GRIND PISTON A OF SUCH SIZE THAT WHEN ASSEMBLED WITH CYLINDER CLEARANCE WILL BE .018
GRIND B WITH .011 CLEARANCE TAPERING TO .008 AT C
NOTE - CYLINDER BORE 3.250 / 3.251
ALL PISTONS ON SAME MOTOR MUST BE SAME WEIGHT
HEAT TREATED AND BRINELL 270 TO 310

GD-23

DEFENDANTS' EXHIBIT GD(2).
Blueprint D-944X of The Aluminum Castings Co. (Drawing of Proposed Design of Pistons for H. H. Franklin Mfg. Co.)
(Filed January 27, 1934.)

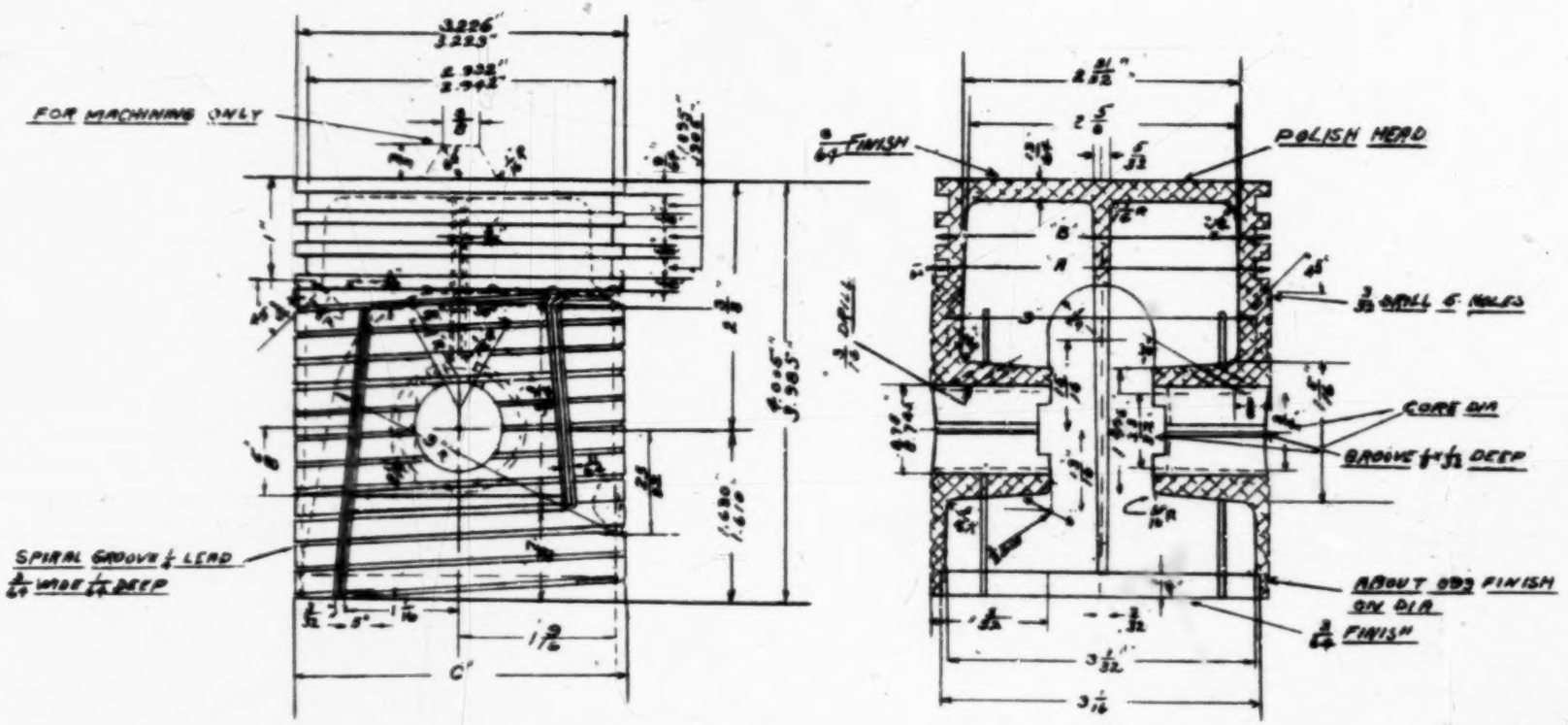
REVISIONS	A	B	C	D	E	F	G
PREVIOUS							
CHANGED							
TO							
SEE							

THE ALUMINUM CASTINGS CO.
CLEVELAND OHIO
DRAWING OF
PROPOSED DESIGN OF PISTON
FOR H.H. FRANKLIN MFG. CO.
CUSTOMER'S NO. [illegible]

-NOTE-
DO NOT SCALE THIS BLUEPRINT
TOLERANCES ON ALL FINISHED DIMENSIONS TO BE ±.010 OF AN INCH UNLESS OTHERWISE SPECIFIED

DATE MAY-8-1933 | SCALE 1" = 1"
ROUGH WEIGHT | FINISHED WEIGHT
DESIGNED BY | MATERIAL ALUMINUM
DRAWN BY Friendly | CHECKED BY Norman
APPROVED J. Anderson

PLANT N | DRAWING SYMBOL D-944X



GRIND PISTONS OF SUCH SIZE THAT WHEN ASSEMBLED WITH CYLINDER CLEARANCE WILL BE .018
GRIND WITH .001 CLEARANCE TAPERING TO .002 AT "C"
NOTE- CYLINDER BORE 3.250" / 3.247"
ALL PISTONS ON SAME MOTOR MUST BE SAME WEIGHT

HEAT TREATED AND BRINELL 302-10

DEFENDANTS' EXHIBIT CC (3).
Blueprint D-960X of The Aluminum Castings Co. (Drawing of Proposed Design of Piston for H. H. Franklin Mfg. Co.)
(Filed January 27, 1934.)

REVISIONS	A	B	C	D	E	F	G
PREVIOUS							
CHANGED							
TO							
SEE							

-NOTE-
DO NOT SCALE THIS BLUEPRINT
TOLERANCES ON ALL FINISHED SURFACES TO BE ±.010 OF AN INCH UNLESS OTHERWISE SPECIFIED

DATE May 20 1932
ROUGH WEIGHT
DESIGNED BY
DRAWN BY
APPROVED
SCALE 1" = 1"
FINISHED WEIGHT
MATERIAL ALUMINUM ALLOY
CHECKED BY

THE ALUMINUM CASTINGS CO.
CLEVELAND, OHIO
DRAWING OF PROPOSED DESIGN OF PISTON
FOR H H FRANKLIN MFG CO
PURCHASERS DRAWING
PLANT N
DRAWING SYMBOL D-960X

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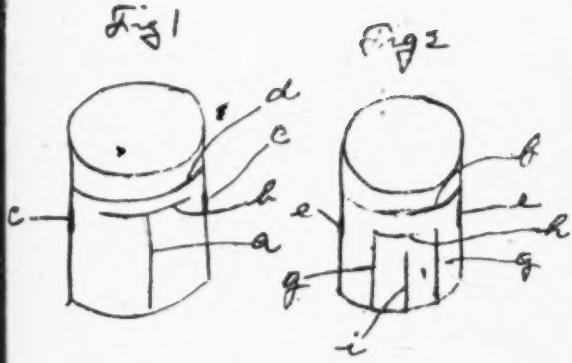
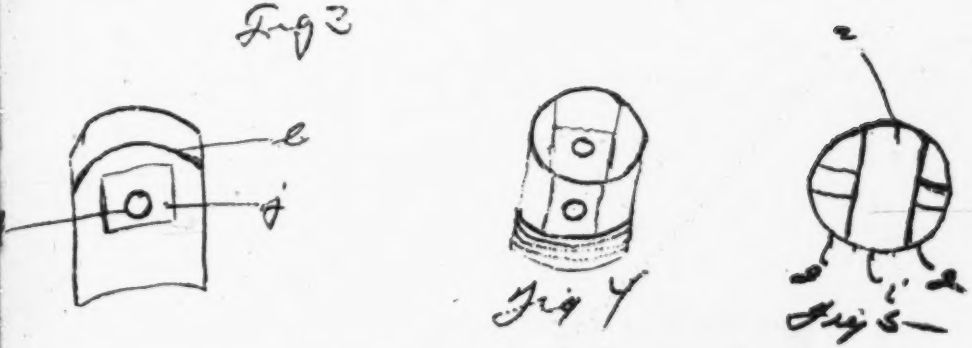
DD

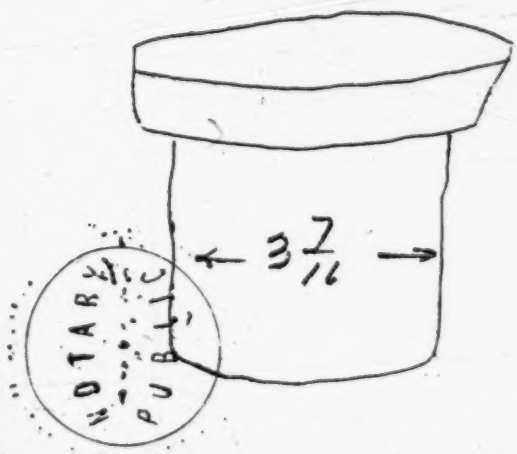




DEFENDANTS' EXHIBIT DD.
Sketch of Long Piston seen by Royalty in 1913.
(Filed January 27, 1934.)

FORM P-5 NAME E. C. Long		ADDRESS Guthrie Ex 31	
PATT. NO. H-4	DESCRIPTION	No. OF CORE BOXES 1	BIN NO. 398
SPECIAL IDENTIFICATION Wood			

DATE RECEIVED	DATE RETURNED	DATE RECEIVED	DATE RETURNED
10/10/19	1/28/20		



DEFENDANTS' EXHIBIT JJ.
Photostat of Pattern Record Card marked H-4.
(Filed January 27, 1934.)

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Fig 1

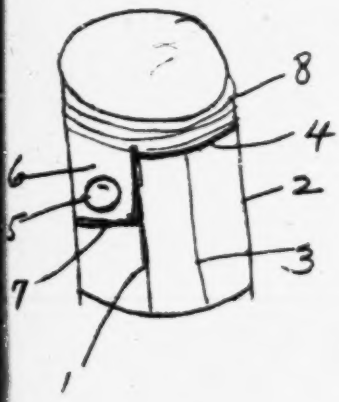
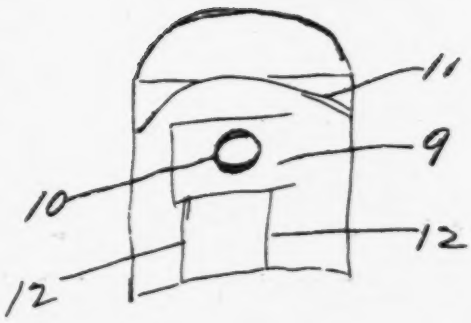


Fig 2



DEFENDANTS' EXHIBIT EE.
Sketch of Long Piston by Royalty in February 1918.
(Filed January 27, 1934.)

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Fig 3

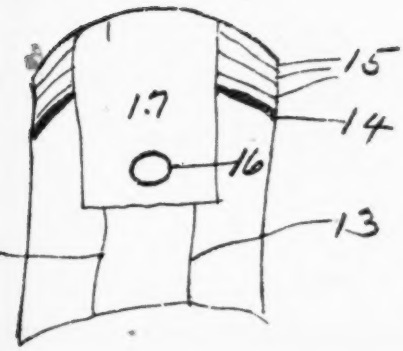
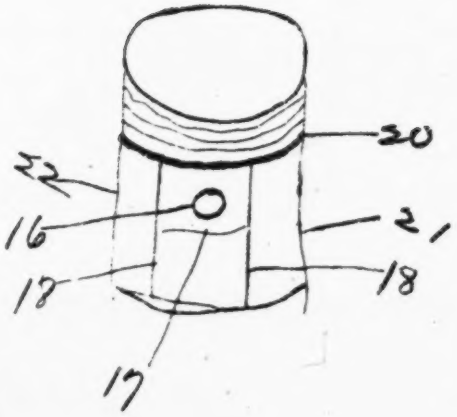


Fig 4



DEFENDANTS' EXHIBIT FF.
Sketch of Other Views of Piston shown in Exhibit EE.
(Filed January 27, 1934.)

1639

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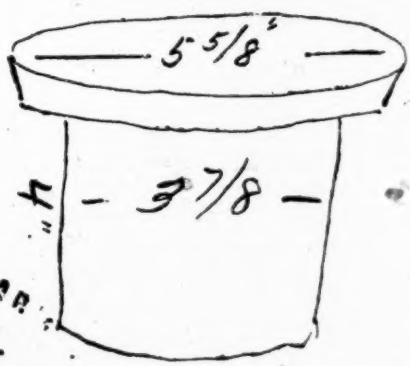
DEFENDANTS' EXHIBIT GG.
Photostat of Pattern Record Card marked D-8764.
(Filed January 27, 1934.)

FORM P-2 NAME E. C. Lang Mfg Co	ADDRESS Gulbit - Ex 31		
PATT. NO. D8764	DESCRIPTION	No. OF CORE BOXES	BIN No.
SPECIAL IDENTIFICATION 1 Wood		1	398

DATE RECEIVED	DATE RETURNED	DATE RECEIVED	DATE RETURNED
1/29/19	1 Wood - Gilbert		
	3/21/19 - 1 Wood - 1 C.B.		



NOTARY PUBLIC

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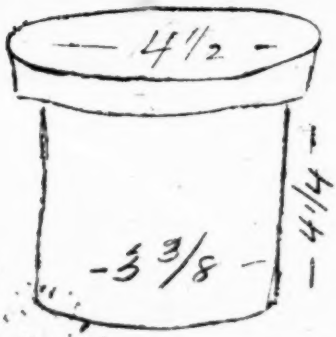
FORM P-2.
NAME E. C. Long Mfg Co ADDRESS Orchard Ex 31

PATT. NO. A640 DESCRIPTION No. OF CORE BOXES BIN No 398

SPECIAL IDENTIFICATION Wood - Gilbert.

DATE RECEIVED	DATE RETURNED	DATE RECEIVED	DATE RETURNED
10/16/18			
12/10/18	- 1 Wood	- 1 C.B.	
	1/16/19		
1/24/19		1	
2/22/19	- 4 Wood	- 1 C.B.	
	3/21/19 -	4 Wood - 1 C.B.	



DEFENDANTS' EXHIBIT HH.
Photostat of Pattern Record Card marked A-640.
(Filed January 27, 1934.)

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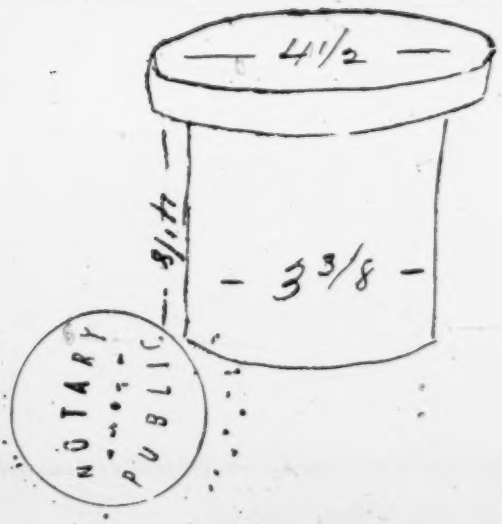
DEFENDANTS' EXHIBIT II.
Photostat of Pattern Record Card marked B-122.
(Filed January 27, 1934.)

FORM P-2.
NAME E C Long Mfg Co ADDRESS Gulick-Ex 31
PATT. NO. B122 DESCRIPTION — No. OF CORE BOXES — BIN No. 398
SPECIAL IDENTIFICATION 1 Wood -

DATE RECEIVED	DATE RETURNED	DATE RECEIVED	DATE RETURNED
12/19/18	2 " 12/31/18	Gilbert	
2/22/19 -	1 Wood -	1 C.B.	
	3/21/19 -	1 Wood - 1 C.B.	



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FIRM P.O. NAME E.C. Long & Co. ADDRESS Gulick-Ex 31

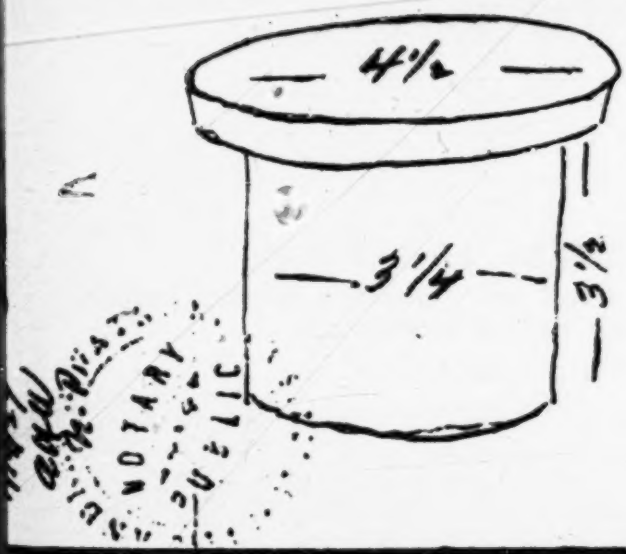
PATTERN NO. C-123 | DESCRIPTION | No. OF CORE BOXES 1 | BIN No. 398

SPECIAL IDENTIFICATION Wood

DATE RECEIVED	DATE RETURNED	DATE RECEIVED	DATE RETURNED
1/25/19	2/6/19		
2/22/19 - 4 Wood		1 C B	
	3/21/19 - 4 Wood - 1		C.B.

570
571

DOCKET DIVISION
MAR 17 1928
U.S. PATENT OFFICE



NOTARY PUBLIC

DEFENDANTS' EXHIBIT KK.
Photostat of Pattern Record Card marked C-123.
(Filed January 27, 1934.)

1644

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FORM P-2.

NAME E. C. Long | ADDRESS LL

PATT. No. A640 | DESCRIPTION | No. OF CORE BOXES | BIN No.

SPECIAL IDENTIFICATION 1 Wood Core Box 398

DATE RECEIVED	DATE RETURNED	DATE RECEIVED	DATE RETURNED
	Use Patt A 640 as per instruction on Core Box 3/21/14		

DEFENDANTS' EXHIBIT LL.

Card bearing notation "Use Pattern A-640 as per instructions on core box."

(Filed January 27, 1934.)

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FORM P-2
NAME E.C. Long M C ADDRESS MM

PATT. NO. A641 | DESCRIPTION | No. OF CORE BOXES 1 | BIN No. 398

SPECIAL IDENTIFICATION Hood

DATE RECEIVED	DATE RETURNED	DATE RECEIVED	DATE RETURNED
4/18/19			

Cindy Watson
1104 Chemical Bldg

DEFENDANTS' EXHIBIT MM.
Card bearing designation, "Patt. No. A-641."
(Filed January 27, 1934.)

PISTON DESIGN.

By Harry R. Ricardo, B.A., A.M.I.C.E.

IN the March issue of *The Automobile Engineer* last year the writer gave a description of a design of aluminium piston which he had employed with considerable success. In this design a serious attempt was made:

(*a*.) To reduce the weight by disposing the material in such a way that the load was transmitted as directly as possible from the crown to the gudgeon pin and from the gudgeon to the bearing surfaces.

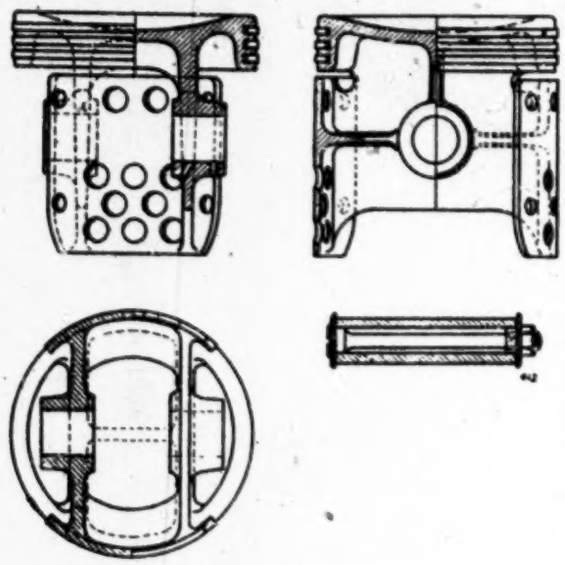

Fig. 1.
Divided slipper piston design for bores up to 5in.

(*b*.) To reduce the area of rubbing surface, thereby reducing the fluid friction of the lubricant.

(*c*.) To reduce the oil consumption and the tendency to carbonise the oil by giving free vent for the lubricant, and thus preventing it from being "rolled up" between the piston and cylinder walls, which was found to be the chief cause of oil reaching the combustion chamber.

(*d*.) To reduce the bending of the gudgeon pin by transmitting the load to it at points as near the centre as the width of the connecting rod small end bearing would permit.

Since that date a very considerable number of these pistons have been made and tested in engines of various kinds, and as a result it has been found that:

(1.) Such pistons complete with gudgeon pins and piston rings are actually about 30% lighter than aluminium pistons of the normal design and of the same thickness of crown.

(2.) The piston friction is actually about 35% less than in the case of a normal trunk piston of the same size and material.

(3.) The oil consumption is lower than in the case of an ordinary trunk piston, and the tendency to carbonise is less.

(4.) The use of a short floating gudgeon pin renders possible a very substantial reduction in the weight of the pin, for not only is the rigidity of the pin greatly increased, with the result that both the diameter and length of bearing serface can be substantially reduced without any measurable wear being detected, but also the rotation of the pin prevents any tendency to unequal or local wear. This is a very important point, for not only do these short floating pins show much less wear than the ordinary type, but also in these very light pistons the weight of the gudgeon pin itself and the small end bearing of the connecting rod constitute a serious proportion of the total reciprocating weight.

This piston, however, in common with all other aluminium pistons, requires a considerable allowance for expansion, with the result that it is liable to be somewhat noisy when cold. In order to reduce the amount of clearance necessary, the writer has recently patented a design in which the connection between the ring-carrying portion of the piston and the slipper surface is severed, so that heat can only be conducted to the slipper surfaces by way of the main webs and not down the sides. The main webs themselves are so designed that the heat conducted from the crown is distributed evenly over the surface of the slippers. The effect of this design is that the bulk of the heat is delivered to the cylinder walls through the piston rings, while only a comparatively small portion reaches the slipper surfaces, and this is distributed evenly over them. Such a design would not be suitable for very large

Fig. 3.

engines on account of the reduced facilities for dissipating the heat from the crown, but for pistons up to 5in. bore at any rate it appears to be quite satisfactory. Experience has shown that with these divided slippers the clearance necessary can be reduced to about one-half of that required for the ordinary type, and to little, if any, more than is required for a cast iron piston. Such a piston of 4in. bore is shown in fig. 1. Several of these pistons have been in use in motor car engines, and their quiet running has been most noticeable.

Fig. 2 shows a further development, in which the bearing surface on the side which does not receive the maximum thrust from the connecting rod has been yet further reduced, and also the main webs

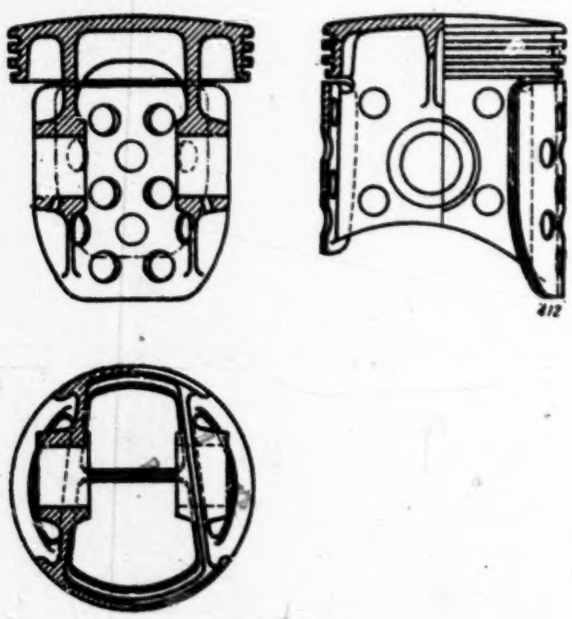

Fig. 2.
Divided slipper piston design with reduced slipper on the side opposite maximum thrust.

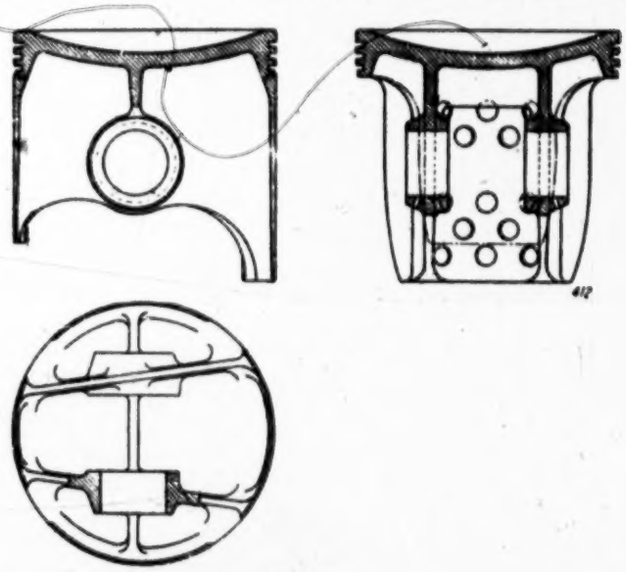

Fig. 4.
Solid slipper piston for engine of 7in. bore.

DEFENDANTS' EXHIBIT 3-S.
Page 274 of "The Automobile Engineer" of October 1918, Vol. VIII, No. 119.
(Filed January 27, 1934.)

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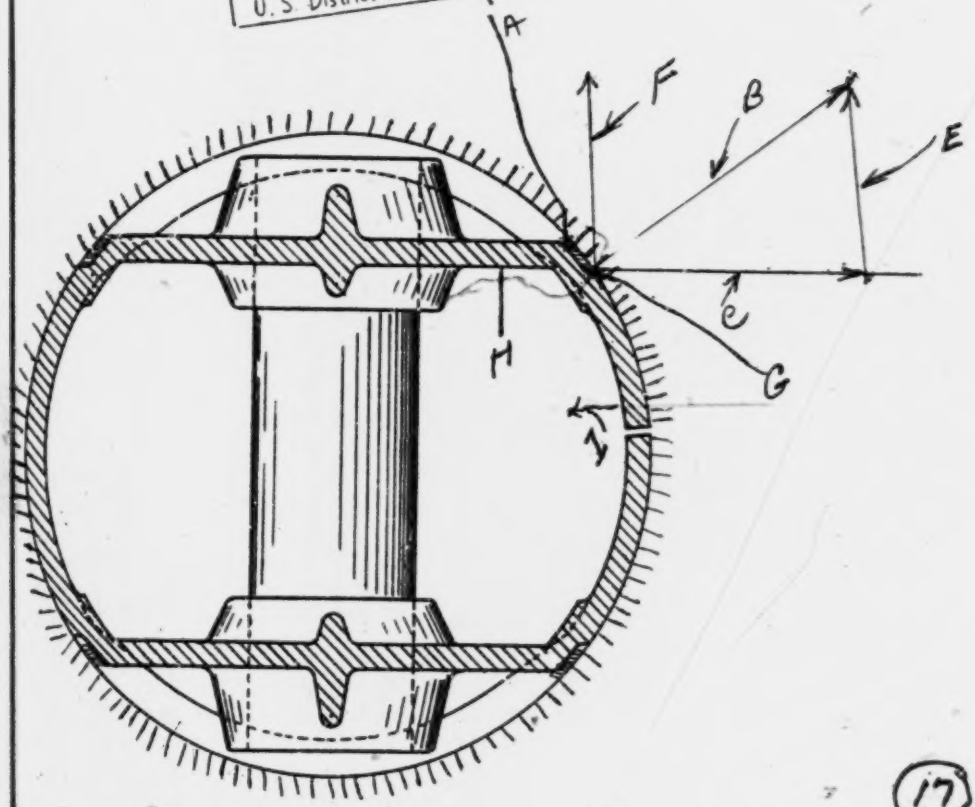
FILED
JAN 27 1934
At ..... O'clock ..... M.
F. J. DENZLER, Clerk
U. S. District Court, N. D. O.

Defts Ex 4-A
30



(17)

DEFENDANTS' EXHIBIT 4-A.
Stellman Sketch of Maynard Patent Structure.
(Filed January 27, 1934.)

1649-1666

DEFENDANTS' EXHIBIT 4-G.
Pages 362, 363 and 364 of "Automotive Industries" for January 29, 1920.
(Filed January 27, 1934.)

30

Aluminum Piston Design*

This discussion divides the problem in two classes and there takes up the details of each class. The four points on which objections to these problems are based—wear, slaps, excessive oil consumption and crankcase dilution—are treated separately.

By E. G. Gunn

FROM a thermal standpoint aluminum pistons may be broadly divided into two classes:

(1) Those designed with the object of conducting the heat away from the head into the skirt and thence into the cylinder walls.
(2) Those designed with the object of partly insulating the skirt from the heat of the piston head.

Those in the first class are usually more or less conventional in design except that they have thicker walls, or ribs extending down from the head. They are generally used for high-duty engines. In these engines, which are usually of a rather large bore and comparatively low speed, the weight of the piston is secondary to its ability to keep the head from overheating, and piston slaps are not of much consequence. Therefore, for heavy-duty engines pistons of the first type seem logical. Sections of some of the types which come under the first group are given in Figs. 1, 2 and 3.

Passenger-Car Engines

For passenger-car engines the conditions are somewhat different. The duty is lighter and the bore usually smaller. This lessens the tendency toward excessive heat. Quietness being important, close-fitting pistons are desirable. Need for good accelerating ability and smoothness in operation makes lightness desirable. These considerations have led to much development work on pistons of the second type. The plan followed in most cases is to partially insulate the skirt from the piston head, thus minimizing the expansion of the skirt due to heat. Some of the ways of accomplishing this are shown in Figs. 4 to 11, inclusive.

Pistons of the Long and Franquist type are split to allow the piston to spring. They can for this reason be fitted more closely than the more conventional types. The conventional type with the comparatively thin wall is probably the most popular, and for the smaller bores serves very well. It is simpler and somewhat cheaper to make than other types. In all the other types shown there has been an attempt to insulate the skirt from the head. This allows the piston to be fitted more closely, thus minimizing piston slaps.

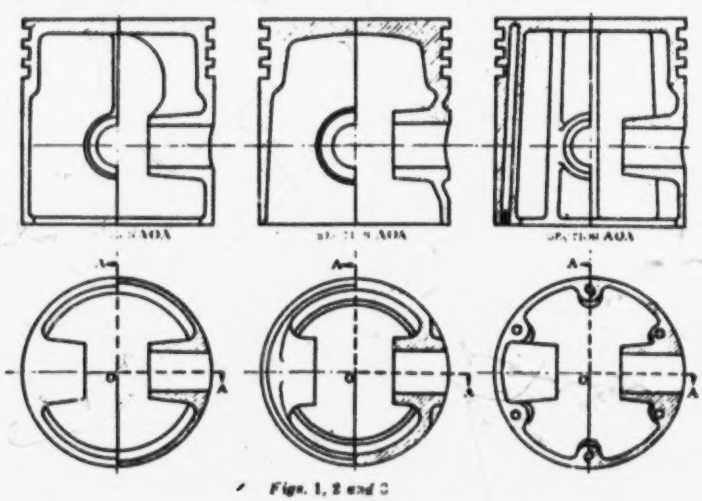
Four points are often brought up as objections to the use of aluminum pistons. These objections are the same as those encountered in the use of cast-iron pistons.

(1) Wear.
(2) Piston slaps.
(3) Excessive oil consumption.
(4) Crankcase dilution.

Wear has been shown to be largely a function of original smoothness. It is unreasonable to expect long life when aluminum pistons are fitted to cylinders of relatively hard material having a rough bore. Aluminum has been shown to be a good bearing metal, but it must run on a smooth surface, as in the case of babbitt metal. Much attention is paid to polishing the journals of a crankshaft, but we often see cylinder bores, whether ground or reamed, which are so rough that they can be marked with a lead pencil, although they may appear to be smooth. This is undoubtedly the cause of a great deal of initial wear on aluminum pistons. When cast-iron pistons are fitted this is not so apparent. Dust in the air also plays a very important part in wear. Engines run on the dynamometer give much longer service than engines in cars.

I have lately examined a truck piston with the top ring worn nearly in two, and with over 1/32-in. side clearance. The rings and piston were

*Paper read at the annual meeting of the S. A. E.



Figs. 1, 2 and 3

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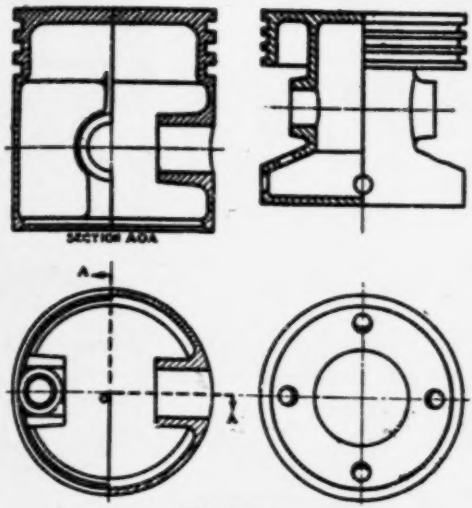


Figs. 4 and 5

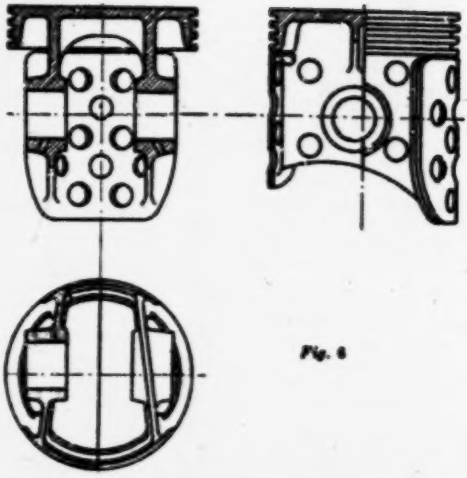
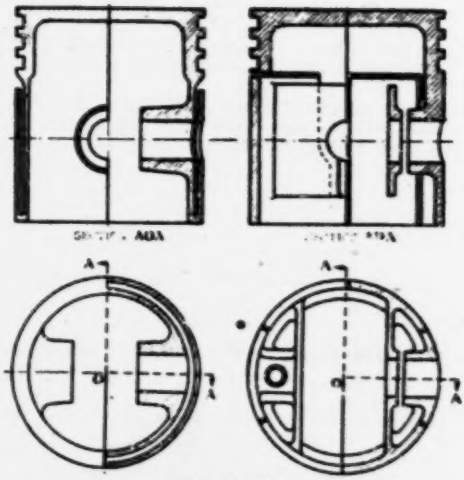


Fig. 6



Figs. 7 and 8

both polished and showed no sign of scoring. This same model has repeatedly stood the same number of hours' running on test with wear so slight as to be hardly measureable. There is no question that an efficient air-cleaning device would greatly prolong piston and cylinder life.

Piston Slaps

Piston slaps can be overcome by using proper clearance. Pistons of the second design tend to make this condition easier to meet. Offsetting the piston-pin also tends to reduce piston slap. With 3½-in. and smaller bores there should be no trouble due to sticking with pistons of the conventional design fitted closely enough to prevent slaps, provided the piston and cylinder are of proper design. There should be no local hot-spots, and care should be taken in the design to prevent a condition tending to warp the cylinder when heated.

Much trouble was experienced with sticking aluminum pistons in a certain inserted-sleeve engine of about 3½-in. bore. The cylinder was in the form of a block aluminum casting, with inserted cast-iron sleeves. Clearances up to 1/64 in. were tried, but still the pistons seized. The sleeves were removed and found to be machined so that there was an air-gap of 0.006 in. between the sleeve and the cylinder wall. These sleeves were replaced with others which fitted all the way down, and pistons with 0.007-in. clearance were then found to be satisfactory.

This is perhaps an exaggerated case, but shows the bad effect of failure to carry the heat away from the cylinder bore rapidly. The top land of the piston must, of course, be given much more clearance than any other part. The next land requires less, and the least clearance can be given to the bottom of the skirt. The tapering necessarily increases rapidly as the top of the piston is approached. When the piston-pin is placed too near the rings, piston slaps are more frequent, for the clearance in the zone near the piston-pin bosses must be sufficient to take care of extreme heat conditions so that under ordinary running conditions this part of the piston has enough clearance to allow piston slaps. When the pin is placed farther from the head the clearance can be small enough to prevent slaps.

Some trouble has also been encountered, due to fitting pins tightly in the piston. When a piston with a tight pin is heated it expands and creeps out on the pin; when it contracts again it hangs to the pin so that the piston has a greater diameter parallel to the pin and a smaller diameter at right angles to it. This condition makes seizing easier and slaps more pronounced. This creeping can be demonstrated readily by applying a blow-torch flame to the head of a piston fitted with a tight pin.

Excessive Oil Consumption

When too much oil is thrown into the cylinder bores, tight-fitting pistons and special rings will not completely overcome the trouble. A great many tests have been run which show this conclusively, demonstrating that:

(1) With no control on the oil being thrown into the cylinder, rings which seal the top and bottom edge of the groove reduced the oil consumption.

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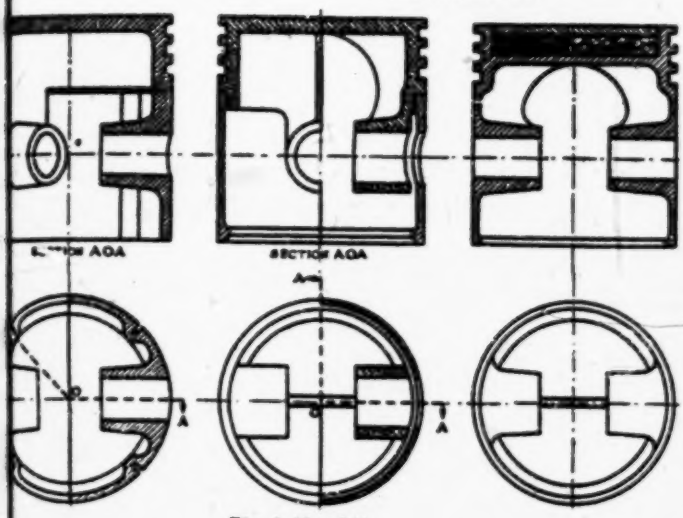


Figs. 9, 10 and 11

(2) When the oil is properly controlled, the oil consumption is very low even with rings having an up-and-down clearance of 0.004 in.

(3) With the oil controlled and with hot water circulated through the engine, the volume of liquid in the oil-pan increased, indicating dilution with fuel which passed the piston and rings. This was independent of the kind of rings used.

The engine was next run with a device arranged to heat the mixture to a temperature of about 160 deg. fahr. This was accomplished in such a way that the maximum amount of heat was applied when idling. The effect upon fuel vaporization was observed through a glass window and was clearly evident. The result was to diminish the amount of fuel in the oil-pan when idling, and the viscosity was not seriously affected thereby.

Before the installation of the heating device a black deposit was found on spark-plugs taken from the cylinders of cars on road test even when the oil consumption was very low.

After the installation the spark-plugs remained clean under all conditions. It has been common practice for a number of years to put a quantity of kerosene in the crankcase oil, when running-in an engine to allow the bearing parts to seat more quickly.

It is fair to expect that crankcase dilution has the same effect and that more rapid wear follows; hence the need for minimizing crankcase oil dilution with unburned fuel.

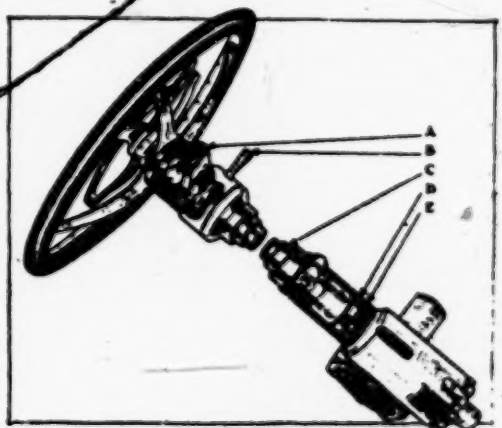
S. S. C. O. Steering Gear Lock

E show herewith an illustration of a novel lock which is applied to the steering gear of a car. The device consists of a spline fitting, which is riveted into the worm gear housing, and of a steel four-spline part attached to a special tube, can be inserted into any standard steering unit. ck itself is located immediately underneath the g wheel. This is said to have hundreds of different ations, and therefore to be absolutely safe.

locking device is covered by patents issued to . Muller, and is being manufactured by the U. S. Service Co., Milwaukee. Samples of this lock are ing tried out on Mitchell, Elgin, Kissel and Ogren nd we understand that the device has the approval Underwriters' Laboratories of Chicago.

lock holds the steering gear rigid at any angle, and e makes driving or towing impossible. As the still be readily pushed short distances, it does not e with police and fire department regulations. The ject of the lock, of course, is to prevent theft ar.

e illustration *A* is a 19 tumbler lock which locks when in the proper position by removing the is a lever, used to raise and lower the clogging *C* and *E*. *C* is a steel tube, attached to the clog at the spline at *E*. *D* is the spline fitting, which d or cast into the worm gear housing, and *F* is the machine-steel four-spline, screwed into the tube *C* and secured with a key.



S. S. C. O. steering gear lock illustrating its important features

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[fols. 1679-1682] **DEFENDANTS' EXHIBIT 4-H(3)**

Prior Art Patent

U. S. Patent No. 1,031,212, July 2, 1912

To E. Van Bever

Expansible Piston

(Filed January 27, 1934)

E. VAN BEVER.

EXPANSIBLE PISTON.

APPLICATION FILED SEPT. 18, 1911.

1,031,212. Patented July 2, 1912.

Fig. 1.

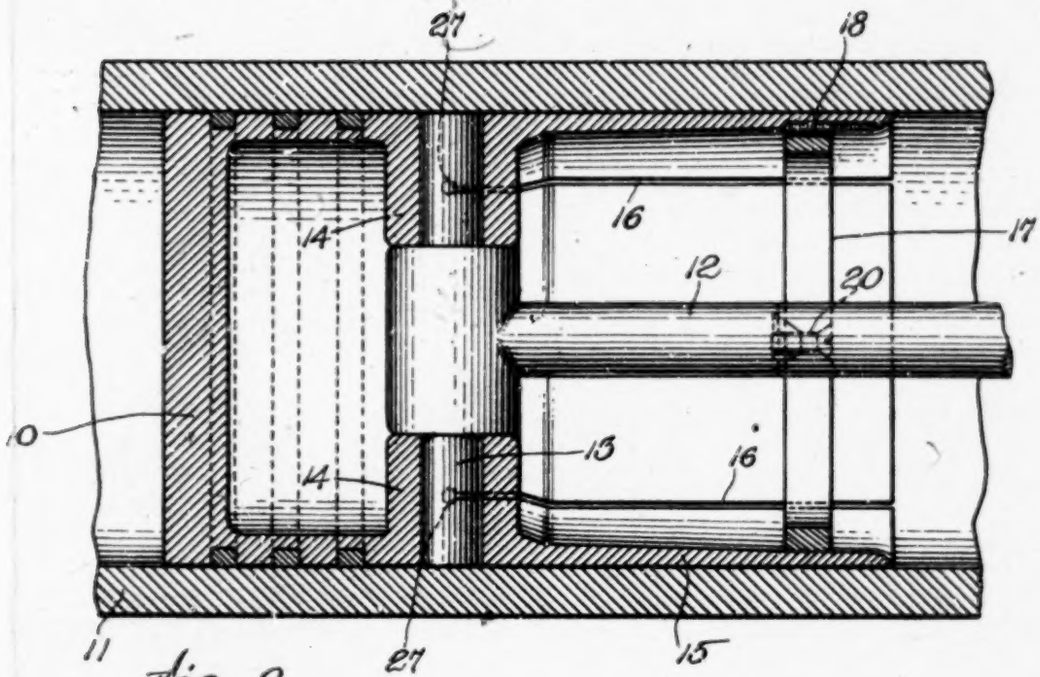


Fig. 2.

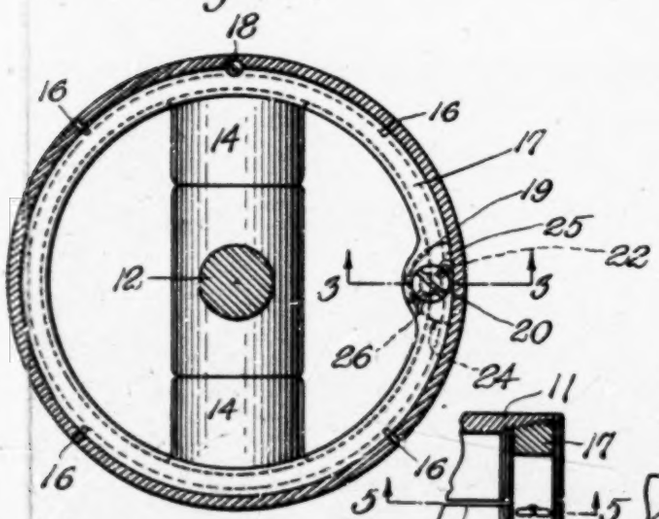


Fig. 3.

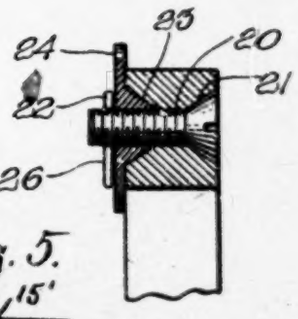
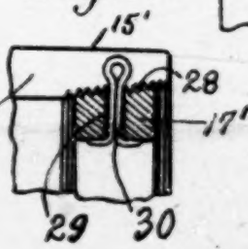


Fig. 4.

Fig. 5.



Witnesses:
C. L. Rogers
Edward Maxwell

Inventor:
Edmond Van Bever,
by Geo. S. Maxwell,
Attorney.

UNITED STATES PATENT OFFICE.

EDMOND VAN BEVER, OF WATERTOWN, MASSACHUSETTS.

EXPANSIBLE PISTON.

1,031,212. Specification of Letters Patent. Patented July 2, 1912.

Application filed September 18, 1911. Serial No. 649,889.

To all whom it may concern:

Be it known that I, EDMOND VAN BEVER, a citizen of the United States, and resident of Watertown, county of Middlesex, Commonwealth of Massachusetts, have invented an Improvement in Expansible Pistons, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to pistons and, while applicable to other and more general uses, is especially designed for use in gas engine construction.

As is well known, the ordinary engine piston or plunger, though it may have been originally formed to closely fit its cylinder, after a period of use wears down to a certain extent and this, along with the wear of the cylinder, makes the piston a loose fit in the cylinder so that it tends to have some small lateral chucking play therein, which is only imperfectly prevented by the packings. This looseness of the piston in its cylinder tends to the premature destruction of the packing rings, as well as requiring special attention to the fitting of these.

The present construction provides a piston formed so as to be expansible from within to take up for the small diminution in its diameter due to wear, so that, even after a considerable period of use, its peripheral dimension may be the same as at the beginning.

The invention will be better understood from the following detailed description taken in connection with the accompanying drawings and will thereafter be pointed out in the appended claims.

Referring to the drawings, Figure 1 is a central longitudinal section showing a piston wherein my invention is carried out, a portion of the cylinder being shown broken away. Fig. 2 is a transverse section taken at the right of Fig. 1, portions of the piston being shown in elevation. Fig. 3 is a detail section on line 3—3 of Fig. 2. Fig. 4 is a fragmentary sectional detail showing another form of expanding mechanism, and Fig. 5 is a section on line 5—5 of Fig. 4.

The piston 10, usually of cast iron, is shown as of the integral hollow shell type with its outer end closed and is fitted to the cylinder 11 and united to a connecting rod 12 by wrist pin 13 fitted to sockets in bosses 14 projecting inward from the hollow shell intermediate of its length. The hollow shell of the piston, as is usual, extends rearwardly for some distance from the wrist pin connection as seen at 15, this rearwardly extending portion being slightly tapered so as to terminate in a relatively thin inner extremity. In the practice of my invention this hollow shell, for a considerable distance from its inner end, is divided into a number of sections, shown as four, by lengthwise slits 16. These slits, which, in the illustrative embodiment shown, extend substantially to the wrist pin connection, though the exact length thereof is not material, may be readily formed by sawing the piston shell with an ordinary metal saw. These sectional portions have a certain amount of springing capacity which need only be very slight for the present purpose, and as a means for expanding them outward to the small extent necessary, I provide an expanding ring 17 fitted into the piston sleeve and held from casual displacement by means shown as a screw bolt 18 tapped in a hole partly in the ring and partly in the piston shell. The ring 17 is divided at the point 19 and the abutting ends at this point are adapted to be forced apart by a screw bolt 20 fitted to a hole formed in the abutting ends, this bolt having a conical head 21 and having fitted thereto a nut 22 with a conical head 23. Thus as the nut 22 is screwed up on the bolt 20, the conical portions 21, 23 force the abutting ring ends apart, causing expansion of the ring and corresponding expansion of the sectional portions of the piston shell. As a means for preventing casual displacement of the nut 22, it is formed with an abutment plate 24 flattened off, as seen at 25 to fit the inside of the piston shell. The screw bolt 20 is likewise prevented from casual displacement after adjustment by having a cotter pin 26 passed through a transverse aperture in its end with its extremity in position to press against the inside of the piston shell, so that both the screw bolt and its nut are thus held against movement, and any desired expanding adjustment of the piston once effected is reliably maintained.

The form of expanding mechanism just described is especially applicable for equipping worn pistons with my invention, since it does not require any machining of the piston. In the case of new pistons which can be conveniently machined the expand-

ing device of Fig. 4 and Fig. 5 may be advantageously employed. As shown in these figures, the inner end 15′ of the piston, which is provided with slots 16 as before described, has an internal tapered thread formed therein as seen at 28, and engaging with this thread is a ring 17′ having a correspondingly tapered and threaded outer periphery. This ring may be screwed into the piston end to expand the sectional portions thereof to the extent desired, and as a suitable means for preventing the working out of this ring, I provide radial holes 29 therethrough at intervals through one or more of which a cotter pin 30 is passed so that its head extends up into a slot 16 without reaching the periphery of the piston, while its inwardly projecting ends may be bent over the ring to prevent dislodgment. Thus the head of the cotter pin engaging with the walls of the slot 16 effectively prevents any turning of the ring and holds the parts in precise adjusted position. The resiliency effected by the slits 16 may be somewhat enhanced if desired by the drilling of holes 27 in the extremities of these slits, though this is not essential to the effective carrying out of the invention.

It will be understood that while a cast iron piston of usual form is shown for illustrative purposes in setting forth the principles of my invention, the invention is not limited to this one form of piston, but may be carried out with various different piston and plunger constructions. The invention is likewise adapted for use in the production of new pistons or for the refitting of old and worn plungers. In the case of a plunger worn by use, all that is necessary is to remove it, saw the slits 16 from its inner end, select an expanding ring of proper size, and fit it to the inside of the shell, this fitting being facilitated by the usual tapering form of the standard types of hollow shell piston from the wrist pin inward.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A piston formed with a hollow shell integral with the main body thereof, there being slits lengthwise through the shell from its inner end, and means for expanding the sectional portions thus formed to take up for wear.

2. A piston formed with a hollow shell integral with the main body thereof, there being a plurality of equally spaced apart lengthwise slits through the inner end portion of the shell, and an internal expander for the sectional shell portions thus formed.

3. A piston, having an inwardly extending shell portion integral therewith with a plurality of equally spaced apart lengthwise extending slits therethrough, and an internal expander for springing out and holding in expanded adjustment the sectional shell portions thus formed.

4. A piston, having a wrist pin fitted to inwardly projecting bosses thereof, and a shell portion extending inwardly from said wrist pin integral with the body of the piston, said shell portion being sectioned by a plurality of equally spaced apart slits into segmental portions, and an internal expanding ring fitted to the interior of said sectional shell portions.

5. A hollow shell piston, having inwardly extending bosses with a wrist pin fitted therein, and a shell portion integral with the piston body extending inwardly from said wrist pin, said integral shell portion having a lengthwise extending slit therethrough, and an internal expander fitted to expand said inwardly extending shell portion.

6. A piston, comprising an integral hollow shell portion with a slot extending lengthwise therethrough for a part of its length, and means for expanding said shell portion to take up for wear.

7. An integral hollow shell piston, having slits lengthwise through the shell from its inner end, and means for expanding the sectional portions thus formed to take up wear, said means consisting in a tapered threaded ring fitted to a tapered threaded seat in the end of the piston.

8. An integral hollow shell piston, having slits lengthwise through the shell from its inner end, and means for expanding the sectional portions thus formed to take up wear, said means consisting in a tapered threaded ring fitted to a tapered threaded seat in the end of the piston, said ring having a radially extending hole therethrough with a pin passed through said hole and engaging with the walls of one of said slits.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

EDMOND VAN BEVER.

Witnesses:
CLYDE L. ROGERS,
EDWARD MAXWELL.

[fols. 1683-1686] **DEFENDANTS' EXHIBIT 4-H(4)**

Prior Art Patent

U. S. Patent No. 1,092,870, April [illegible], 1914,

To E. O. Spillman & L. P. Mooers

Piston for Explosion Engines for Motors

(Filed January 27, 1934)

E. O. SPILLMAN & L. P. MOOERS.

PISTON FOR EXPLOSION ENGINES OR MOTORS.

APPLICATION FILED JULY 18, 1913.

1,092,870.

Patented Apr. 14, 1914.

Fig. 1.

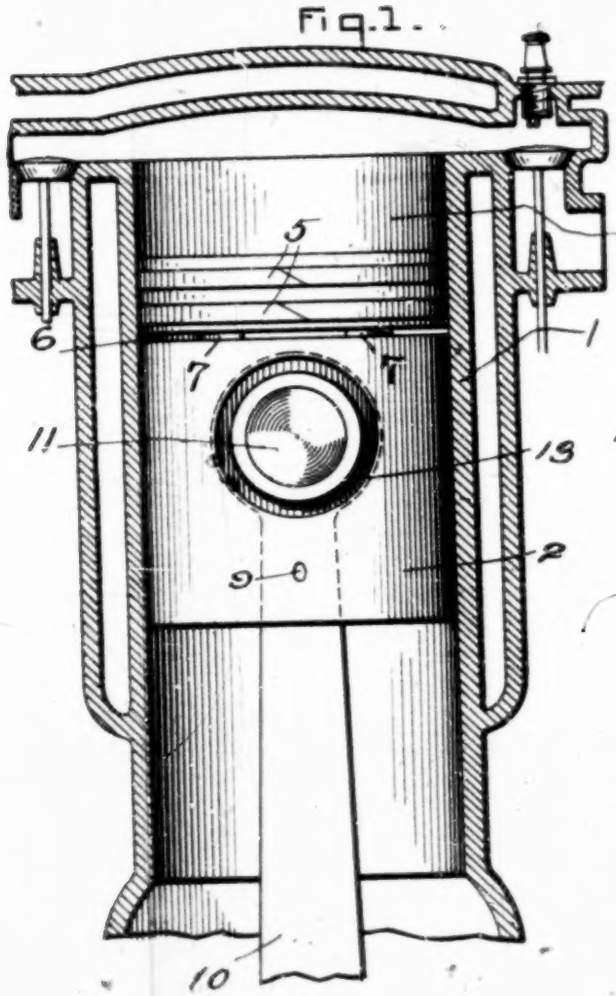


Fig. 2.

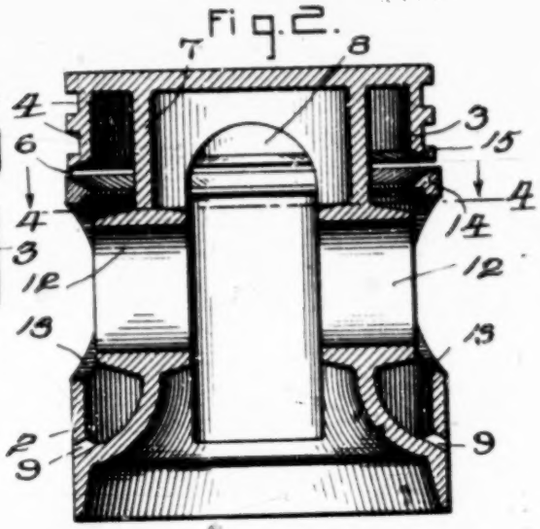


Fig. 3.

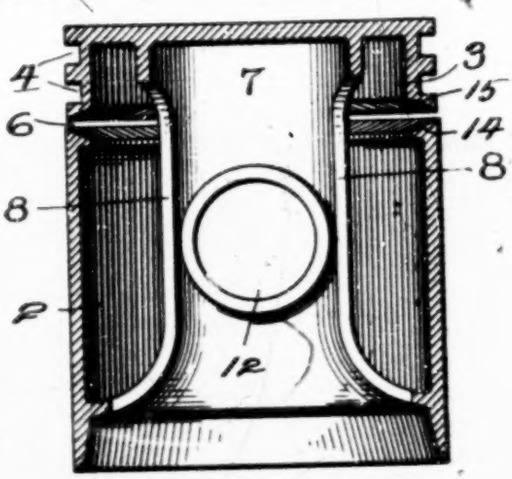
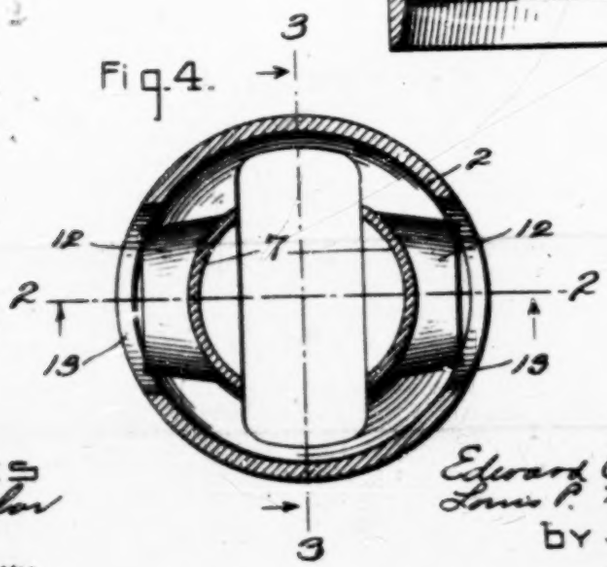


Fig. 4.



WITNESSES

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Walter O. Geyer.

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Louis P. Mooers.

BY Geyer Popp

ATTORNEYS

UNITED STATES PATENT OFFICE.

EDWARD O. SPILLMAN AND LOUIS P. MOOERS, OF NORTH TONAWANDA, NEW YORK.

PISTON FOR EXPLOSION ENGINES OR MOTORS.

1,092,870. Specification of Letters Patent. Patented Apr. 14, 1914.

Application filed July 18, 1913. Serial No. 779,757.

To all whom it may concern:

Be it known that we, EDWARD O. SPILLMAN and LOUIS P. MOOERS, citizens of the United States, residing at North Tonawanda, in the county of Niagara and State of New York, have invented new and useful Improvements in Pistons for Explosion Engines or Motors, of which the following is a specification.

This invention relates more particularly to the pistons of explosion engines or motors.

As ordinarily constructed, the head and the body of the piston are integral or continuous, and the head, which is subjected to the full heat of the gas, transmits the same to the body. The resulting expansion of the body causes the same to bind in the cylinder, scoring or grooving the latter in time; or if the piston-body is fitted loosely enough to avoid scoring, it rattles in the cylinder and fails to compress the explosive mixture to the proper degree, impairing the efficiency of the motor.

It is the object of our invention to so construct the piston that the conduction or transmission of heat from the head to the body or guide portion of the piston is reduced to a minimum. Expansion of the body is thus diminished practically to that of the cylinder and the body may be closely fitted therein, thereby obtaining the maximum efficiency of the motor, avoiding rattling of the piston, and at the same time preventing scoring of the cylinder.

In the accompanying drawings: Figure 1 is a sectional elevation of a motor provided with the improved piston. Figs. 2 and 3 are longitudinal sections of the piston on the correspondingly numbered lines in Fig. 4, the packing rings being omitted. Fig. 4 is a transverse section thereof on line 4—4, Fig. 2.

Similar characters of reference indicate corresponding parts throughout the several views.

1 indicates a motor cylinder of any ordinary construction, the cylinder forming no part of our invention.

2 indicates the body or guide-portion of the piston, and 3 the head or front portion thereof which is shown as having the customary annular grooves 4 for receiving the usual packing rings 5.

The wall of the head, instead of being integral or continuous with the wall of the body, is isolated or separated from it by a gap or space 6 of suitable width to avoid or minimize transmission of the heat from said head-section to said body or guide-section and thereby prevent objectionable expansion of the latter. This gap may be produced by a saw cut made after machining and before grinding the piston.

The head and guide sections of the transversely-divided piston are tied together by any suitable connection, that shown in the drawings consisting of a tubular longitudinal web 7 arranged within the hollow sections and cast in one piece therewith.

In the construction illustrated in the drawings, the web is separated from the surrounding walls of the head and guide sections by a comparatively wide space, and the upper end of this connecting web joins the back of the head section, while its lower end joins the guide-section near its lower end or at a point remote from the non-conducting gap 6, whereby the amount of heat transmitted through the web from the head to the guide-section is reduced to a negligible degree, not only on account of the remoteness of the lower end of the web from the gap, but because the web is constantly cooled by the large volume of oil in the crank case. To permit circulation of the lubricant through the web and also reduce the weight of the piston, the web may be provided in opposite sides with openings 8, but these openings are not essential and the web may be imperforate, if desired. Oil holes or channels 9 may also be extended through the guide-section above the lower end of the web, as shown.

10 indicates the usual connecting rod of the motor and 11 the wrist-pin journaled in suitable bearings 12, which in the preferred construction shown, are integral with the web 8, as seen in Fig. 2. Opposite and in line with these bearings the guide-section may be provided with openings 13 for lubricating purposes.

The guide-section 2 is of the proper diameter to closely fit the cylinder and obtain the maximum efficiency of the motor, while the head-section 3 is sufficiently smaller in diameter than the guide-section to remain out of contact with the cylinder-wall under the maximum expansion of the head-section; this close fit of the guide section being permitted without danger of scoring the cylinder, by reason of the isolation of its wall

or skirt from the wall of the head-section, which prevents undue expansion of the guide-section, as hereinbefore described. The body-section is long or extensive relative to the head-section and acts as a guide or cross-head therefor which receives all the side thrust of the connecting rod and keeps the head-section out of contact with the cylinder-wall at all times, causing it to operate freely and noiselessly.

As shown, the guide-section is extended forwardly or upwardly beyond the wrist-pin and in practice preferably terminates about a sixteenth of an inch short of the inner end of the head-section to leave the isolating gap 6.

This improved construction combines the important advantages of maximum engine efficiency, smooth and noiseless action of the piston and non-scoring of the cylinder; and these are obtained by simple means which do not materially increase the cost of the piston.

Preferably the upper edge of the piston body is beveled or inclined toward the axis of the piston, as shown at 14, while the lower edge of the piston-head is beveled in the reverse direction, as shown at 15. By this construction, on the upward stroke of the piston the lower beveled edge 14 deflects or crowds the surplus oil back into the piston, while on its downward stroke, the upper beveled edge 15 performs the same function.

We claim as our invention:

1. A piston comprising a head-section, a guide-section having its peripheral wall isolated from the corresponding wall of the head-section by a non-conducting gap extending practically around the piston, the guide-section being relatively long to form a cross head, and means connecting said sections.

2. A piston comprising a head-section, a guide-section forming a cross head and having its wall isolated from the wall of the head-section by a narrow non-conducting gap, and means connecting said sections.

3. A piston comprising a head-section, a separate guide-section therefor, means connecting said sections, and a wrist-pin bearing, the wall of the guide-section extending forwardly beyond the wrist-pin bearing and terminating short of said head-section to leave a non-conducting gap between said sections.

4. A piston comprising a head-section, a guide-section having its wall isolated from the wall of the head-section by a narrow non-conducting gap, and a web arranged lengthwise within said guide and head-sections and connecting the same, said web being located at a distance from the walls of said sections.

5. A piston comprising a head-section, a relatively long guide-section having its wall isolated from the wall of the head-section by a non-conducting gap, and an internal web connecting said sections and joining the guide-section at a point remote from said gap.

6. A piston comprising a head-section, a guide-section isolated from the head-section by a non-conducting gap, said guide-section being provided in opposite sides with openings, an internal web connecting said head-section with the guide-section, and wrist-pin bearings mounted on said web in line with said openings and isolated from the wall of the guide-section and the edges of said openings.

7. A piston comprising a guide-section, a head-section isolated from the guide section by a non-conducting gap, and a tubular web arranged within said sections and connecting the same, the web being provided with one or more oil openings.

8. A piston comprising a guide-section, a head-section isolated from the guide-section by a non-conducting gap, and an internal tubular web connecting said sections and separated from the surrounding piston-wall, said wall being provided with oil holes.

9. A piston comprising a guide-section, a head-section separated therefrom by a gap, and means within the piston connecting said sections, that end of the guide-section forming the rear edge of said gap being provided with an oil deflecting face.

10. A piston comprising a guide-section, a head-section separated therefrom by a gap, and means within the piston connecting said sections, that end of the guide-section forming the rear edge of said gap being beveled to slope toward the axis of the piston.

11. A piston comprising a guide-section, a head-section separated therefrom by a gap, and means within the piston connecting said sections, the adjacent ends of the said sections being beveled inwardly in opposite directions.

Witness our hands this 11th day of July, 1913.

EDWARD O. SPILLMAN.
LOUIS P. MOOERS.

Witnesses:
C. F. GEYER,
E. M. GRAHAM.

[fols. 1687-1716] **DEFENDANTS' EXHIBIT 4-H(5).**

Prior Art Patent.

U. S. Patent No. 1,153,902, Sept. 21, 1915,

To G. E. Franquist.

Piston.

(Filed January 27, 1934.)

698

G. E. FRANQUIST.

PISTON.

APPLICATION FILED AUG. 1, 1914.

1,153,902. Patented Sept. 21, 1915.

Fig. 1.

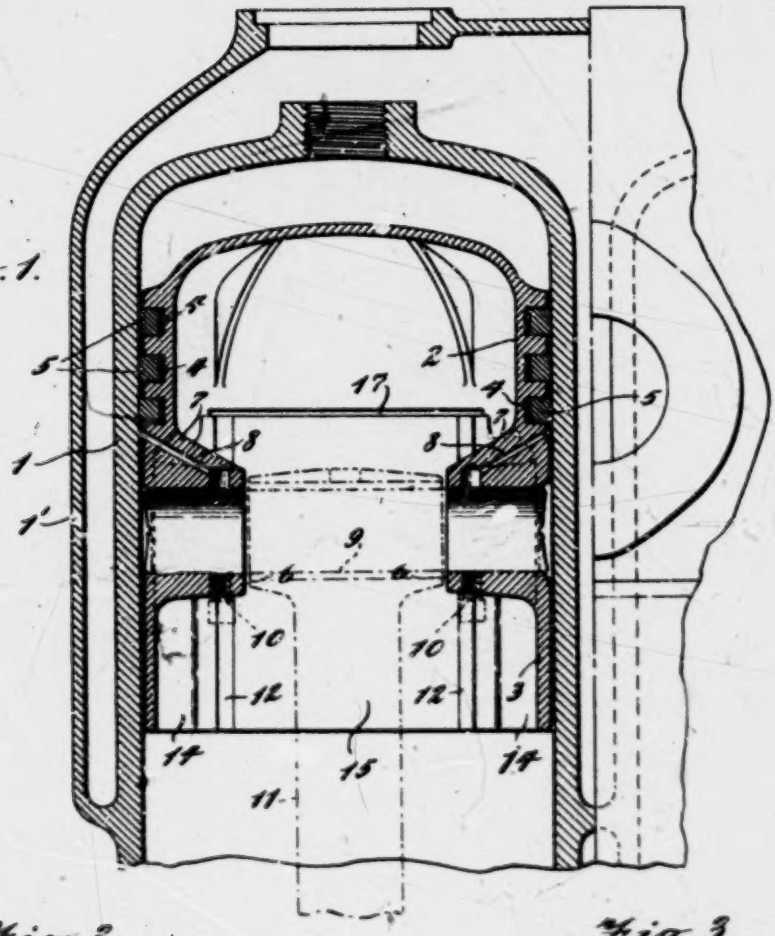


Fig. 2.

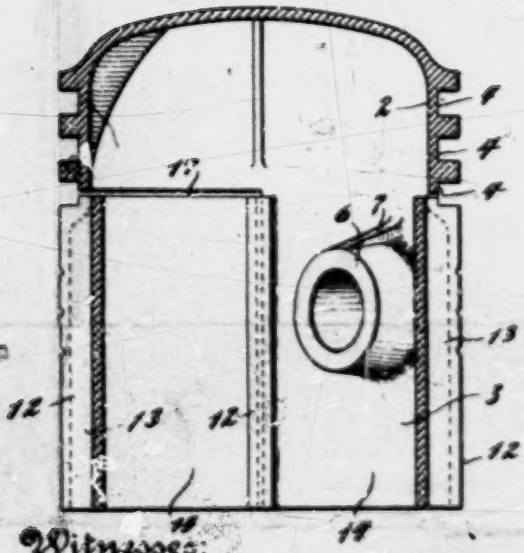
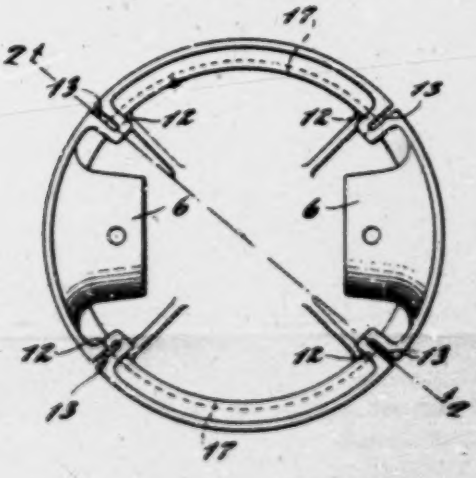


Fig. 3.



Witnesses:
Geo. L. Lehmann
Henry Barkley

Inventor
Gustave E. Franquist.

By his Attorneys
Rosenbaum, Stockbridge & Boot

UNITED STATES PATENT OFFICE.

GUSTAVE E. FRANQUIST, OF NEW BRUNSWICK, NEW JERSEY.

PISTON.

1,153,902. Specification of Letters Patent. Patented Sept. 21, 1915.

Application filed August 1, 1914. Serial No. 854,484.

To all whom it may concern:

Be it known that I, GUSTAVE E. FRANQUIST, a citizen of the United States, residing at New Brunswick, in the county of Middlesex and State of New Jersey, have invented certain new and useful Improvements in Pistons, of which the following is a full, clear, and exact description.

This invention relates to internal combustion engines and has for its primary object the provision of a piston which will eliminate the piston clatter at all speeds and temperatures of the motor.

With this object in view, the invention consists of a piston having a sleeve which is circumferentially compressible and is adapted to have a snug sliding fit in the cylinder when cold, so that upon an expansion of the piston its sleeve will automatically yield sufficiently to prevent the piston from sticking in the cylinder, and after the cylinder has also expanded will again automatically resume substantially its normal size and take up the free play between the cylinder and piston, which would otherwise occur.

The invention also consists of the constructions which will be hereafter described in detail and particularly pointed out in the appended claims.

In the accompanying drawings Figure 1 shows a central longitudinal section through a cylinder and a piston constructed in accordance with the principles of this invention; Fig. 2 is a central longitudinal section of the piston on the line 2—2 shown in Fig. 3; and Fig. 3 is a bottom plan.

Referring to the drawings, 1 designates broadly the cylinder and 1′ the water jacket of an internal combustion engine, the particular construction of which forms no part of the present invention. The piston shown may be regarded as comprising two parts, a head 2 and a sleeve 3, the head extending rearwardly to the rear end of the rearmost piston ring, while the remaining portion of the piston constitutes the sleeve. The head of the piston is provided with circumferential grooves 4 in which the piston rings 5 are adapted to be loosely fitted. Extending inwardly from the inner peripheral surface of the sleeve at diametrically opposed points are the piston pin bosses 6. These bosses are provided with ribs 7 through which an oil groove or hole 8 is bored in order to supply the lubricating material to a crank pin 9, which is suitably fitted in journals provided in these bosses, and is held in place therein by set screws 10. The pin 9 carries a connecting rod 11, the construction thus far described being typical of the ordinary hollow "trunk" piston.

As is the usual practice, the circumferential surface of the head of the piston, or that portion which lies between the piston rings, is machined so as to fit very loosely within the cylinder to permit an expansion of the piston when heated, and is usually from .010 to .020 of an inch less in diameter than the diameter of the cylinder. The piston rings are also fitted in the grooves to allow them to have some lateral movement. The head of the piston does not therefore serve to prevent the piston from rattling within the cylinder. It is necessary then to depend upon the sleeve of the piston to prevent the rattling or clapping of the piston within the cylinder and heretofore it has been customary to allow .002 to .005 free play between the sleeve of the piston and the cylinder to take care of the expansion of the piston before the cylinder walls become heated and to prevent the piston from sticking. After the engine has been running for a comparatively long period the cylinder walls expand, since the water in the jacket becomes heated and the same necessity for compensating for the expansion of the piston does not arise. When the sleeve fits as loosely as this within the cylinder, the piston will set up a rattling and clapping in the cylinder while it remains comparatively cool, *i. e.*, while the motor is picking up, and against after the cylinder has expanded so that the noise resulting therefrom may be heard by the driver and occupants of the car, if the internal combustion engine is used on an automobile. In order to prevent this rattling, it is proposed to use a piston having a sleeve which is circumferentially compressible so that it may be fitted snugly to the cylinder when cold and will automatically take care of the expansion of the piston. One embodiment of such a construction is shown in the drawings and will now be described. Projecting inwardly from the inner surface of the sleeve are longitudinal ribs 12 which preferably extend the entire length of the sleeve substantially parallel to the axis of the piston to a point on a level with the middle of the rearmost piston ring. Longitudinal slots 13 are cut in the outer surface of the sleeve and extend into these ribs, form-

ing the longitudinal grooves in the same. These slots divide the sleeve of the piston into longitudinal sections 14—14 and 15—15, the sections 14—14 carrying the piston pin bosses 6.

Circumferential slots 17—17 are cut in the outer surface of the sleeve in the sections 15—15 respectively, which slots extend to and join the longitudinal slots of 13, separating the longitudinal sections 15 from the head of the piston. The sections 14—14 which carry the piston pin bosses remain integrally connected to the piston head 2 and are relieved from a point on a level with the rearmost piston ring to a point below the piston pin bosses, approximately .005 of an inch on the side, to insure that upon the expansion of the piston the portion of the sleeve which carries the bosses will be prevented from sticking to the cylinder walls and causing either the motor to stop, or the breakage of the parts. In machining a piston of this character, the sleeve is given a relatively snug sliding fit within the cylinder even when cold; or in other words, the piston may be so accurately fitted to the cylinder that even when the piston is cold and the motor is starting there will be no rattling or undesirable noises produced by the actuation of the piston as the motor picks up and the temperature of the piston rises. Due to high temperature of the explosive gases the piston will commence to expand and the cylinder walls will therefore exert a pressure on the same which must be relieved in order to prevent the piston from sticking. It is obvious, however, that as the piston expands the longitudinal sections 15—15 which are separated from the head of the piston and the other portions of the sleeve, by the slots 13 and 17, will move inwardly under the pressure which is exerted on these sections by the cylinder walls until the slots 13 and 17 are closed. However, these slots are made sufficiently large to insure that this will not occur. The rear ends of the sections 14—14 will yield similarly to sections 15—15. It is obvious, then, that the only portions of the sleeve which cannot yield due to the pressure exerted by the cylinder walls on the expanding piston, are those portions of the sleeve opposite the piston pin bosses, and, as has already been stated, these portions of the sleeve are relieved .005 of an inch or more on the side so that there will be no liability of these portions of the sleeve sticking to the cylinder walls. The circumference of the piston will therefore be decreased the desired degree and the piston will operate within the cylinder without sticking, while maintaining a snug sliding fit therein which will prevent any rattling. After the motor has been running a comparatively long period of time the water in the jacket becomes heated and the cylinder expands, but any free play which would otherwise occur will be taken up by the sections of the sleeve which have been compressed resuming their normal position. Another advantage of a sleeve of this character is that in a multi-cylinder engine it is customary to connect one or more of the cylinders together, which, when the cylinders expand, will cause a distortion of the cylinders from a true circle in cross section. By making the sleeve compressible in the manner described, any distortion of the cylinder will cause one or more sections of the piston to yield and the sticking of the piston which has heretofore taken place will be obviated.

While I have shown a particular embodiment of my invention for constructing a piston which is adapted to be compressed circumferentially under the pressure which is exerted by the cylinder walls upon the sleeve of an expanding piston, yet it is not my intention to be limited to the particular construction shown, as the invention is capable of various modifications and it is my intention to cover broadly a piston having a sleeve which is adapted to be compressed circumferentially by the pressure exerted by the cylinder walls when the piston is expanding so that the piston will at all speeds and temperatures of the motor, have a snug sliding fit within the cylinder, which will prevent any rattling of the piston.

What I claim as new and desire to secure by Letters Patent, is:

1. In combination with the cylinder of an internal combustion engine, a piston comprising a head and a sleeve, said sleeve being automatically circumferentially compressible under the pressure exerted by the cylinder walls upon said sleeve when said piston expands.

2. In combination with a cylinder for an internal combustion engine, a piston comprising a head and a sleeve integral therewith, said sleeve being automatically compressible under the pressure exerted by the cylinder wall upon said sleeve when said piston expands.

3. A piston for internal combustion engines, having a head and a sleeve integral therewith, said piston having a circumferential slot therein separating a portion of said sleeve from said head and longitudinal grooves in said piston joining said circumferential slot, forming a section of said sleeve capable of bodily movement relative to the remainder of said sleeve.

4. A piston for internal combustion engines, comprising a head and a sleeve integral therewith, said piston having a circumferential slot therein dividing a portion of said sleeve from said head, longitudinal ribs formed on the inner peripheral surface of said sleeve, said ribs having longitudinal

grooves therein, joining said circumferential slot.

5. A piston for internal combustion engines, comprising a head and a sleeve integral therewith, said piston having a circumferential slot therein on a level with the rearmost piston ring, and ribs on the interior surface of said sleeve extending from the bottom of said sleeve to said slot, said ribs having longitudinal grooves therein joining the ends of said circumferential slot.

6. A piston for internal combustion engines, having a head and a sleeve, said sleeve having a rib on its inner surface extending the entire length of said sleeve, said sleeve having a slot therein extending into said rib and forming a longitudinal groove therein.

7. In an internal combustion engine, a cylinder, a piston therein comprising a sleeve having a snug sliding fit in said cylinder at all temperatures of said piston.

8. In an internal combustion engine, a cylinder, a piston comprising a head and sleeve, said sleeve having the portions thereof whose peripheral surfaces are in sliding contact with the walls of said cylinder automatically circumferentially compressible under the pressure exerted by said cylinder walls upon said sleeve when said piston expands.

9. In an internal combustion engine, a cylinder, a piston comprising a head and a sleeve integral therewith, said sleeve having the portions thereof whose peripheral surfaces are in sliding contact with the walls of said cylinder automatically circumferentially compressible under the pressure exerted by the said cylinder walls upon said sleeve when said piston expands.

10. In an internal combustion engine, a cylinder, a piston comprising a head and a sleeve, piston pin bosses projecting from the interior of said sleeve at a point adjacent the head of the piston, said sleeve comprising longitudinal sections some of which are bodily movable inwardly under the pressure exerted by the walls of said cylinder upon the same as the piston expands, and others of which, which carry the piston bosses, having the portions thereof extending outwardly from the piston bosses toward the free end of the sleeve also bodily movable and having their surfaces opposite the piston bosses of reduced diameter so that these portions are not in sliding contact with the walls of the cylinder.

11. In an internal combustion engine, a cylinder, a piston therefor, a head and a sleeve integral therewith, piston pin bosses extending from the interior surface of said sleeve, said piston having a circumferential slot therein on a level with the rearmost piston rim, and ribs on the interior surface of said sleeve extending from the bottom of said sleeve to said slot, said rib having longitudinal grooves therein joining the ends of said circumferential slot, and the external surface of said sleeve being relieved opposite the piston pin bosses whereby said portions of the sleeve do not contact with the cylinder walls.

In witness whereof I subscribe my signature in the presence of two witnesses.

GUSTAVE E. FRANQUIST.

Witnesses:
WALDO M. CHAPIN,
JULE ZELENKO.

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[fols. 1717-1726] **DEFENDANTS' EXHIBIT 4-H(11).**

Prior Art Patent.

U. S. Patent No. 1,294,833, Feb. 18, 1919,

To H. R. Ricardo.

Piston for Internal Combustion Engines.

(Filed January 27, 1934.)

703

H. R. RICARDO.

PISTON FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED APR. 23, 1918.

1,294,833. Patented Feb. 18, 1919.

FIG. 1.

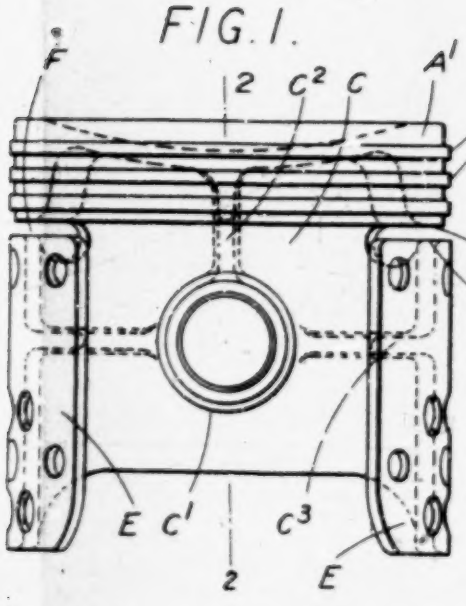


FIG. 2.

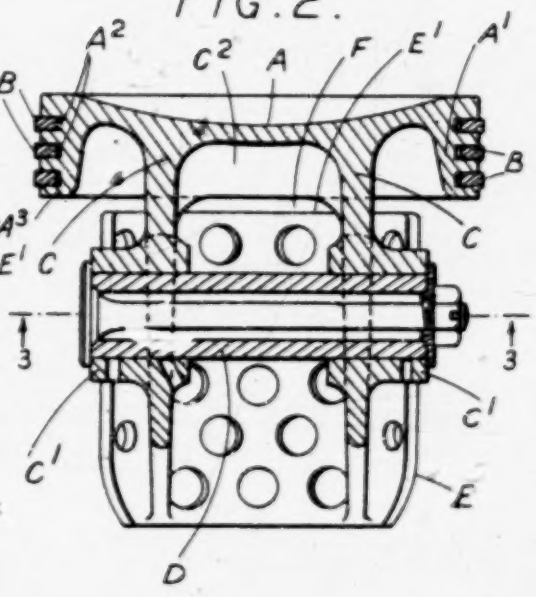
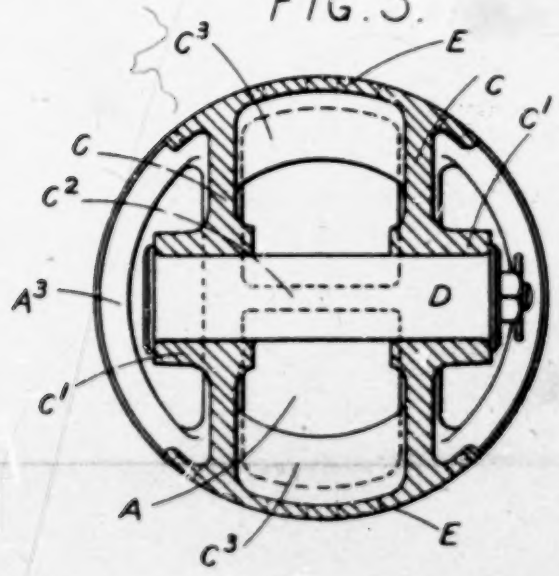


FIG. 3.



Inventor.
Harry R. Ricardo,
By Fosket, Freeman, Watson & Coit,
Attorneys.

UNITED STATES PATENT OFFICE.

HARRY RALPH RICARDO, OF LONDON, ENGLAND.

PISTON FOR INTERNAL-COMBUSTION ENGINES.

1,294,833. Specification of Letters Patent. Patented Feb. 18, 1919.

Application filed April 23, 1918. Serial No. 230,355.

To all whom it may concern:

Be it known that I, HARRY RALPH RICARDO, a subject of the King of England, residing at London, in England, have invented certain new and useful Improvements in Pistons for Internal-Combustion Engines, of which the following is a specification.

This invention relates to pistons for internal combustion engines and has for its object to effect certain improvements in a known type of piston in which the piston head performs solely piston functions while the guiding is performed by members disposed on either side of the gudgeon pin, these guide members being extensions from the piston head flange.

In the design of piston for internal combustion engines, more especially pistons which are constructed of aluminium or aluminium alloy one of the difficulties which arises is due to the large clearance that must be allowed between the piston and the cylinder walls in order to permit of expansion. In an aluminium piston of normal design if sufficient provision is made to allow for expansion when the piston attains its highest temperature the clearance when the parts are cold is then so great that considerable noise is caused as the annular thrust of the connecting rod is reversed on passing the dead centers and consequently the piston is thrust from one side of the cylinder to the other, causing noise. By means of the present improvements this noise is reduced, as the piston is so designed that a large working clearance is not required.

According to this invention the piston comprises a flanged head of such diameter that it is a loose fit within the cylinder, with the wall of which it does not come in contact, the flange being provided with grooves in which are piston rings, and a guide portion which is a sliding fit in the cylinder and comprises two curved members or slippers between which lies the gudgeon pin. This guide portion is adapted to take the whole of the side thrust from the connecting rod and each of the curved members is separated by a continuous gap from the adjacent edge of the piston head flange. Webs carry the gudgeon pin and constitute the only connection between the curved guide members and the face of the piston head disk, with all of which parts the webs are integral. The arrangement of the webs is such that heat will be so conveyed from the piston head to the slippers as to be distributed equally over the whole surfaces of the slippers. The webs comprise two main members which may or may not be arranged parallel and are integral with and spring from the face of the piston head disk, each main portion of these webs being formed with a boss adapted to carry the gudgeon pin. The two curved guide members or slippers are oppositely disposed so as to inclose the gudgeon pin bosses, these slippers being as mentioned connected to and formed integral with the webs and through the latter connected to the piston head and gudgeon pin bosses.

The accompanying drawings illustrate by way of example one construction of piston in accordance with the present invention. In these drawings,

Figure 1 is a side elevation of the improved piston.

Fig. 2 is a sectional elevation on the line 2—2 of Fig. 1.

Fig. 3 is a transverse section on the line 3—3 of Fig. 2 looking in the direction of the arrows.

Like letters indicate like parts throughout the drawings.

The head of the piston comprises a disk portion A which is conveniently dished as shown in Fig. 2, and a flange A′, the diameter of which is such in relation to the internal diameter of the cylinder that a large clearance is provided and the piston head will not come at all in contact with the cylinder walls. In the flange A′ are grooves A^2 in which are carried piston rings B. Two main webs C spring from the piston head A across which they extend and with which they are formed integral. These webs C are parallel to each other in the construction shown in the drawings and project to a convenient distance from the head of the piston head. In each web C is formed a boss C′ adapted to carry the gudgeon pin D which may be of suitable construction and either adapted to float in the bosses C′ or be fixed therein as found desirable. On either side of the gudgeon pin bosses C′, the webs C extend laterally and unite with two curved guide or slipper members E which are integral with the webs so that the latter constitute the connection between the slipper members and the piston head A. It is desirable to provide also a small central

transverse web C^2 which springs from the face of the piston head A and lies between and connects with the parallel webs C. Small supplementary webs C^3 are also conveniently provided across the inner side of the guide slippers E and between the webs C with each of which parts these supplementary webs C^3 are integral.

As will be clearly seen in Figs. 1 and 2, the upper edge E′ of each curved guide member E is separated by an unbroken continuous gap F from the adjacent opposed edge A^3 of the piston head flange A′. Thus while the guide members E are rigidly connected to the piston head A they are not in contact with the piston head flange.

Holes are preferably made through the slippers E as shown in Figs. 1 and 2.

The two webs C serve to distribute both the pressure and the heat delivered to the crown of the piston. The whole of the thrust and such heat as thus passes through the webs C are transmitted to the guide members E and distributed equally over them owing to the manner in which the guide members are joined to the webs C. By reason of the guide members E being separated at their edges from the piston head, heat can only pass from the latter to the guide members through the webs C and then only in such a manner as to effect satisfactory and equal distribution of the heat over the guide surfaces. Moreover the total amount of heat delivered to the bearing surfaces of the guide members is reduced and these surfaces can be freely lubricated. As a result of the reduced heat flow to the crosshead portion of the piston, which is composed of the guide members E and more especially as a result of the even distribution of heat over all the guide surfaces it becomes possible to provide a less clearance for expansion. In the case of a normal construction of piston the heat is transmitted from the piston head along the trunk and consequently the heat which flows through the upper part of the trunk immediately beyond the piston rings is excessive while toward the lower or outer end of the trunk the heat is relatively slight.

Though the present invention is more especially intended to be employed in the construction of a piston formed of aluminium or aluminium alloy, it is to be understood that it is equally applicable to a piston formed of cast iron, the details of construction being modified or not as found necessary.

The shape and dimensions of the slipper members may be varied as also the other details of the construction such as the width of the gap between the slipper members and the piston head flange and the shape and disposition of the webs. Thus for example the bearing surface of one slipper member may have a greater area than the bearing surface of the other slipper member, the two slipper members then being conveniently of different widths when measured in the circumferential direction. In such a construction instead of the webs C being parallel to each other these webs may be inclined and extend between the lateral edges of one slipper member and the corresponding lateral edges of the other slipper member.

What I claim as my invention and desire to secure by Letters Patent is:—

1. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having an integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap extending in the circumferential direction, two webs which are integral with and spring from the head disk and are connected to and integral with the guide members and constitute the only connection between the face of the piston head disk and the guide members, and gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members as set forth.

2. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having a relatively short integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved relatively long members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap of small width extending in the circumferential direction, two webs which are integral with and spring from the head disk and are connected to and integral with the guide members and constitute the only connection between the face of the piston head disk and the guide members, and gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members as set forth.

3. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having an integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being sepa-

rated from the head flange by a continuous gap extending in the circumferential direction and the diameter of the guide thus formed by these two curved members being slightly greater than the diameter of the piston head, two webs which are integral with and spring from the head disk and are connected to and integral with the guide members and constitute the only connection between the face of the piston head disk and the guide members, and gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members as set forth.

4. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having a relatively short integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved relatively long members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap of small width extending in the circumferential direction and the diameter of the guide thus formed by these two curved members being slightly greater than the diameter of the piston head, two webs which are integral with and spring from the head disk and are connected to and integral with the guide members and constitute the only connection between the face of the piston head disk and the guide members, and gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members as set forth.

5. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having an integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap extending in the circumferential direction, two webs which are integral with and spring from the head disk and are connected to and integral with the lateral portions of the guide members and constitute the only connection between the face of the head disk and the guide members, and gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members as set forth.

6. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having a relatively short integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved relatively long members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap of small width extending in the circumferential direction, two webs which are integral with and spring from the head disk and are connected to and integral with the guide members and constitute the only connection between the face of the piston head and the guide members, gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members, and a web formed integral with the piston head disk and extending transversely across this disk between the two main webs as set forth.

7. In a position for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having an integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap extending in the circumferential direction, two parallel webs which are integral with and spring from the head disk and are connected to and integral with the guide members and constitute the only connection between the face of the piston head disk and the guide members, and gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members as set forth.

8. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having a relatively short integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved relatively long members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap of small width extending in the circumferential direction and the diameter of the guide thus formed by these two curved members being slightly greater than the diameter of the piston head, two webs which are integral with and spring from the head disk and are connected to and integral with the lateral portions of the guide members and constitute the only connection between the face of the head disk and the guide members, gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members, and a web formed integral with the piston head disk and extending transversely

across this disk between the two main webs as set forth.

9. In a piston for an internal combustion engine the combination of a piston head adapted to perform solely piston functions and comprising a disk having a relatively short integral peripheral flange in which are annular grooves, piston rings in these grooves, two curved and similar relatively long members oppositely disposed with relation to the axis of the piston and together adapted to perform solely guiding functions, each curved member being separated from the head flange by a continuous gap of small width extending in the circumferential direction and the diameter of the guide thus formed by these two curved members being slightly greater than the diameter of the piston head, two parallel webs which are integral with and spring from the head disk and are connected to and integral with the guide members and constitute the only connection between the face of the piston head disk and the guide members, gudgeon pin bosses formed in these webs in which they are so positioned as to lie between the guide members, and a web formed integral with the piston head disk and extending transversely across this disk between the two main webs as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HARRY RALPH RICARDO.

Witnesses:
A. J. HALL,
R. BAGGOTT.

[fols. 1727-1730] **DEFENDANTS' EXHIBIT 4-H(13).**

Prior Art Patent.

U. S. Patent No. 1,395,441, Nov. 1, 1921,

To E. C. Long.

Piston.

(Filed January 27, 1934.)

709

E. C. LONG.

PISTON.

APPLICATION FILED DEC. 9, 1918.

1,395,441. Patented Nov. 1, 1921.

Fig. 1.

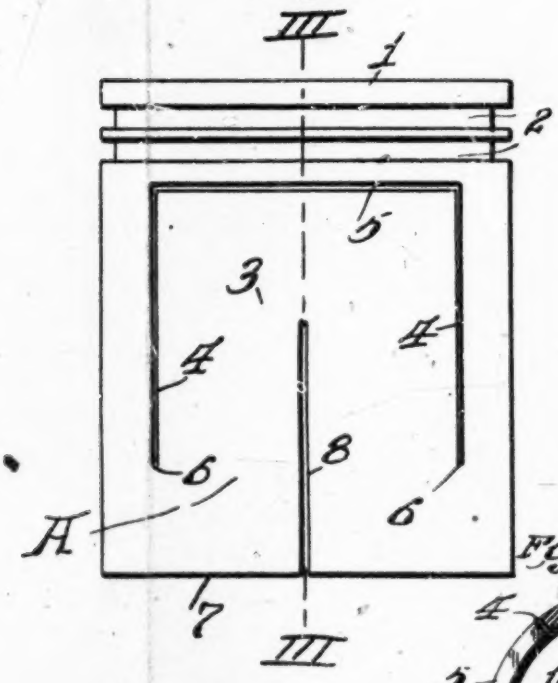


Fig. 2.

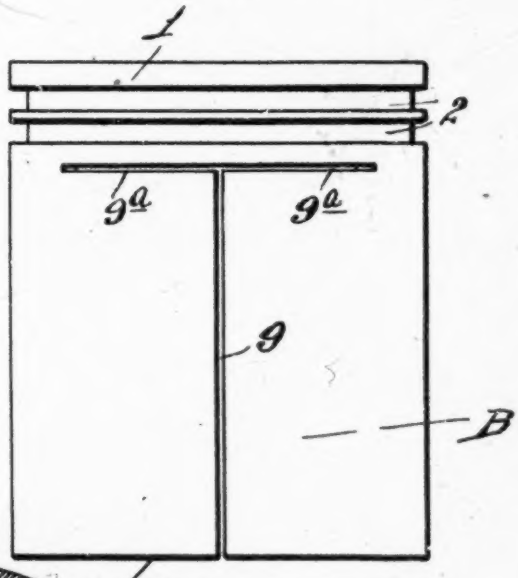


Fig. 5.

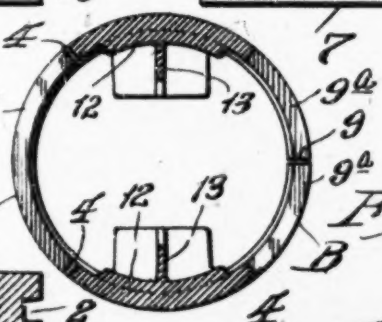


Fig. 3.

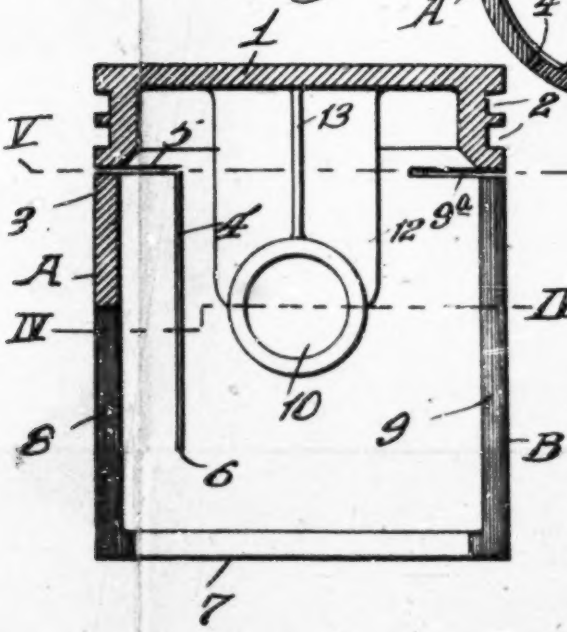
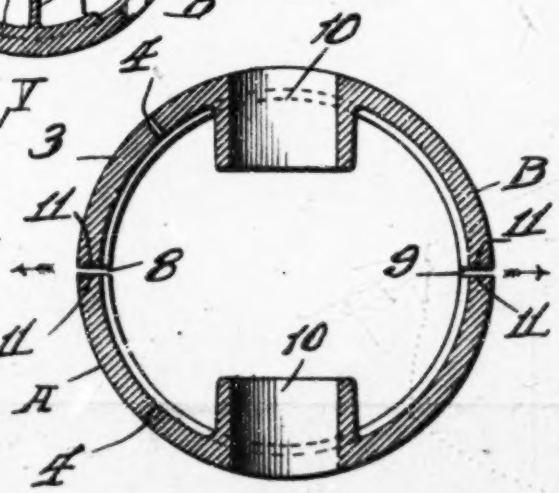


Fig. 4.



Inventor:
Elmer C. Long.
By L. G. Hatcher
atty.

UNITED STATES PATENT OFFICE.

ELMER C. LONG, OF QUINCY, ILLINOIS.

PISTON.

1,395,441. Specification of Letters Patent. Patented Nov. 1, 1921.

Application filed December 9, 1918. Serial No. 265,947.

To all whom it may concern:

Be it known that I, ELMER C. LONG, a citizen of the United States of America, and a resident of Quincy, in the county of Adams and State of Illinois, have invented certain new and useful Improvements in Pistons, of which the following is a specification.

This invention relates to improvements in pistons.

One of the objects of this invention is to provide an improvement in a piston which is more especially used in internal combustion motors in which means are provided in the piston whereby a better fitting relation is provided thereto relative to the cylinder in which the piston is adapted to reciprocate.

Another object of the invention is to provide an improved piston in which the lower and intermediate portions thereof are capable of expanding and contracting more readily than heretofore relative to the heat contained in the cylinder.

A further object of the invention is to provide an improved piston in which the back-slap or connecting rod thrust will be eliminated.

Other and further objects will appear in the specification and be specifically pointed out in the appended claims, reference being had to the accompanying drawings, in which,

Figure 1 is a side elevation of this improved piston.

Fig. 2 is a side elevation opposite to that shown in Fig. 1.

Fig. 3 is a vertical section taken on the line III—III of Fig. 1.

Fig. 4 is a horizontal section taken on the line IV—IV of Fig. 3.

Fig. 5 is a horizontal section on a reduced scale taken on the line V—V of Fig. 3.

Referring to the drawings the solid end 1 of the piston has the usual piston ring recesses 2 formed therein. In order to more fully describe this improved invention that portion of the piston shown in Fig. 1 will be hereinafter designated the A-side portion, whereas that portion in Fig. 2 will be hereinafter designated as the B-side portion.

Formed in the side portion A is a cut-out tongue shaped portion 3, said tongue portion being formed by a pair of vertically cut slots 4 and a horizontally cut slot 5 adjoining the upper ends of said slots 4, the lower ends of the slots 4 terminating as shown at 6 a distance above the lower end 7 of the piston. Leading from the lower end of the piston in the side portion A is a vertically formed slot 8 which extends upwardly intermediate of the tongue portion 3 and terminates at a point about midway of the length of said tongue portion.

Centrally arranged in the side portion B of the piston is a vertically formed slot 9 which extends from the lower end of the piston 7 and terminates a short distance below the lower piston ring recesses 2, and there being a pair of horizontally formed slots 9^a leading from the vertically formed slot 9, said slots 9 and 9^a forming a T-shape. This slot 9 is diametrically opposite from the slot 8. The slots 8 and 9 are also arranged at right angles to the wrist pin openings 10.

Heretofore in the manufacture and use of pistons for internal combustion motors, due to their having a solid peripheral cylinder bearing surface, the diameters of said pistons have to be turned off to diameters that are much less than the diameters of the cylinders in which they are to reciprocate, on account of the fact that extreme expansion of the piston has to be taken care of in order to prevent too much friction which is caused by too tight a fit of the piston in the cylinder. With this improved piston in which the tongue portion 3 is formed and in which the vertically formed slots 8 and 9 are contained, a closer fit may be established between the piston and its cylinder during the assembly. Then when a motor equipped with these improved pistons is in operation upon the greatest expansion of the piston, the expanding forces against the peripheral surfaces of the piston will engage the cylinder wall with a pressure only great enough to automatically accommodate a proper sliding relation of the piston relative to the cylinder; whereas the excess crowding or expansion will be carried out in the slots 4, 8 and 9 of the piston, thereby preventing undue frictional wearing of the piston against the cylinder.

The construction of the tongue shaped portion 3 is formed in the intermediate portion of the piston for the purpose of taking care of the expansion and contraction of said intermediate portion, said tongue shaped portion, however, also being assisted by the slot 9, whereas the slot 8 and lower

end of the slot 9 will provide for the expansion and contraction of the lower end of the piston.

In a piston of this improved character it is preferable to have the solid end 1 of the piston of a lesser diameter across the peripheral surface adjacent the piston ring recesses 2 than the remaining lower portion of the piston, said lesser diameter adjacent the solid end of the piston not being considered relative to this improved invention, as the usual type of piston rings mounted in the recesses will automatically take care of the proper expanding, contracting and packing relation relative to said solid piston end.

The slots 9ª which adjoin the vertical slot 9 adjacent the piston ring recesses 2 prevent the expansion and contraction strains of the solid piston end 1 from traveling directly onto the side B of the piston, in which instance said strains will be dispersed along the wrist pin sides of the piston.

In order to take care of the aforementioned backslap of the piston which is generally given to the lower end of pistons from the throwing-thrust of the connecting rod, attention is called to the disposition of the vertically formed slots 8 and 9 which are diametrically opposite from one another and arranged at right angles to the wrist pin openings 10. These slots 8 and 9, however, weaken the lower portion of the piston relative to the expansion and contraction thereof, but in the disposition of said slots as mentioned the bending moment of the edges 11 thereof is transferred circularly therefrom, the side portions A and B in which the slots 8 and 9 are respectively located will provide a reinforcement to the piston against the connecting rod swinging-thrust.

As shown more clearly in Figs. 3 and 5, enlarged portions 12, each of which is reinforced by the rib 13, are provided for reinforcing the bearings formed by the wrist pin openings 10.

What I claim is:

1. A piston having a tongue-shaped portion formed on its peripheral face, and a longitudinally formed slot extending into said tongue portion.

2. A one piece piston closed at one end and having a pair of longitudinally arranged diametrically opposed slots formed in its peripheral face, thereby providing disconnected peripheral portions capable of moving outwardly or inwardly without restraint, and there being a transverse slot located adjacent the closed end of the piston adjoined intermediate of its ends by one of said other slots.

3. A piston having a pair of longitudinally arranged diametrically opposed slots formed in its peripheral face, one of said slots being shorter than the other slot.

4. A piston having a tongue-shaped portion formed on its peripheral face, a longitudinally formed slot extending into said tongue portion, and a second longitudinally formed slot diametrically opposed to said first-mentioned slot.

5. A piston having a solid end portion and a T-shaped slot formed in the peripheral face of the piston in which the transverse portion of said T-shaped slot is disposed adjacent the solid end of the piston, said slot forming adjacent disconnected peripheral portions which are capable of unrestrained outward and inward movement.

6. A piston having a solid end portion, a tongue-shaped portion formed on the peripheral face of the piston, having its face end located adjacent the solid end portion, and a longitudinally formed slot extending from the lower end of the piston into said tongue portion.

7. A piston having a tongue-shaped portion formed on its peripheral face, a T-shaped slot oppositely disposed from said tongue-shaped slot, and a longitudinally formed slot extending into said tongue portion.

8. A piston having a tongue-shaped portion formed on its peripheral face, a longitudinally formed slot extending into said tongue portion, and a second longitudinally formed slot diametrically opposed to said first-mentioned slot adjoining a transversely formed slot.

9. A piston having a solid end portion, a tongue-shaped portion formed on the peripheral face of the piston, having its free end located adjacent the solid end portion, a longitudinally formed slot extending from the lower end of the piston into said tongue portion, and a T-shaped slot disposed opposite from said tongue portion.

10. A one piece piston provided with a solid end portion and a skirt portion, said skirt portion having a longitudinally extending slot formed through the thickness of its wall, said slot extending from the rear edge of the skirt portion and forming adjacent disconnected portions in said skirt portion which are capable of being moved inwardly or outwardly without restraint.

ELMER C. LONG.

[fols. 1731-1734] **DEFENDANTS' EXHIBIT 4-H(14).**

Prior Art Patent.

U. S. Patent No. 1,489,499, April 8, 1924,

To E. C. Long.

Piston for Internal Combustion Motors.

(Filed January 27, 1934.)

713

April 8, 1924. 1,489,499

E. C. LONG

PISTON FOR INTERNAL COMBUSTION MOTORS

Filed Dec. 9, 1918

Fig. 1

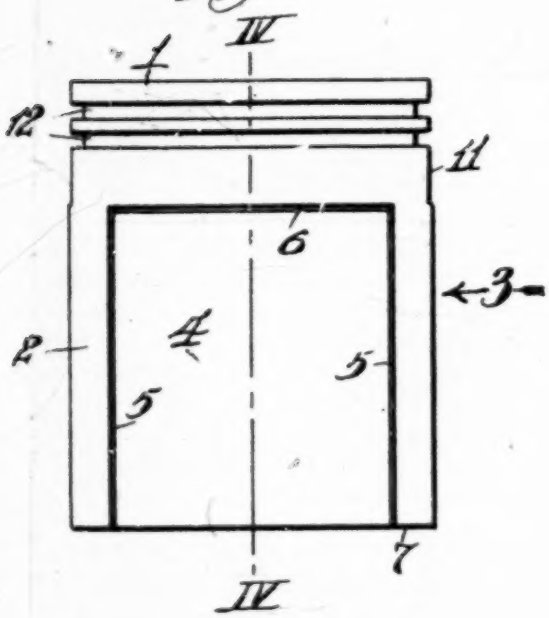


Fig. 2.

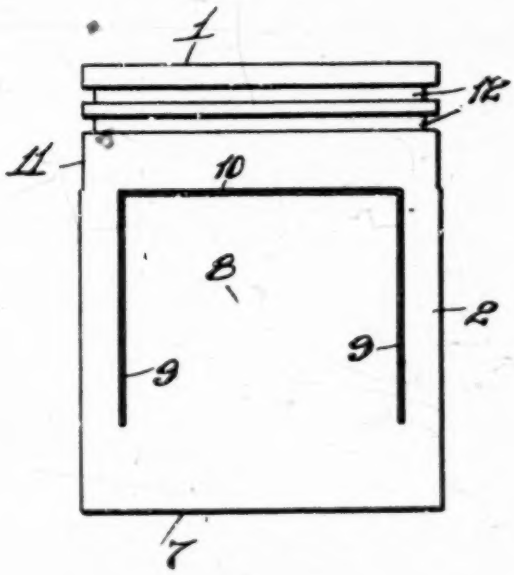


Fig. 3.

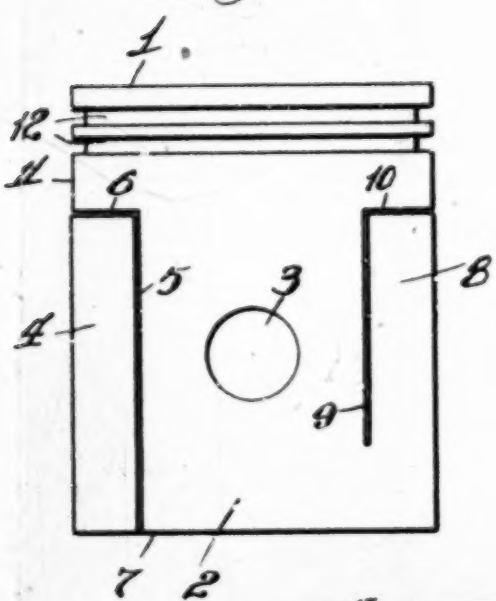


Fig. 4.

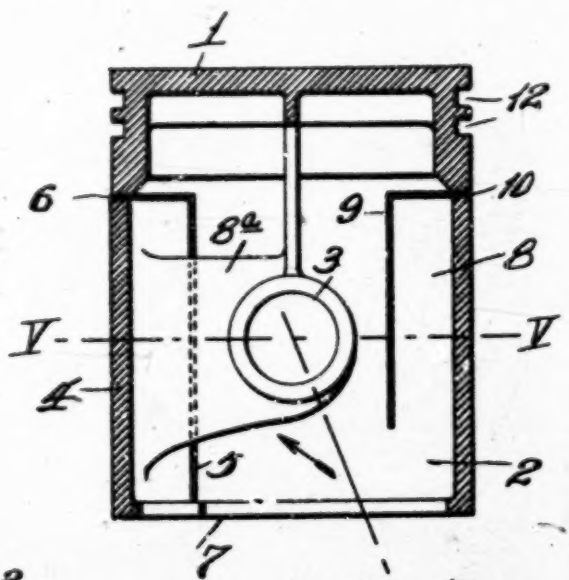


Fig. 5.

Inventor:
Elmer C. Long.
By D. G. Fletcher
Atty.

Patented Apr. 8, 1924. 1,489,499

UNITED STATES PATENT OFFICE.

ELMER C. LONG, OF QUINCY, ILLINOIS.

PISTON FOR INTERNAL-COMBUSTION MOTORS.

Application filed December 9, 1918. Serial No. 265,946.

To all whom it may concern:

Be it known that I, ELMER C. LONG, a citizen of the United States of America, and a resident of the city of Quincy, in the county of Adams and State of Illinois, have invented certain new and useful Improvements in Pistons for Internal-Combustion Motors, of which the following is a specification.

The primary object of this invention is to provide an improved piston for internal combustion motors, whereby a better working relation is established between the piston and its cylinder during the operation of the motor under highly heated conditions.

Another object is to provide an improvement in a piston, whereby the working thrust due to the piston forcing the connecting rod is received by only one part of the piston surface, and not on the whole piston as heretofore.

Other and further objects will appear in the specification and be specifically pointed out in the appended claims, reference being had to the accompanying drawings exemplifying the invention, and in which,

Figure 1 is a side elevation of this improved piston.

Figure 2 is a side elevation opposite to that shown in Fig. 1.

Figure 3 is a side elevation taken in the direction of the arrow 3 in Fig. 1.

Figure 4 is a vertical section taken on the line IV—IV of Fig. 1.

Figure 5 is a transverse section taken on the line V—V of Fig. 4.

Referring to the drawings 1 designates a solid head of the piston, 2 the main body portion, and 3 the wrist pin bearings. Formed on one side of the main body portion 2, as shown more clearly in Fig. 1, is a cut out portion 4 which is formed in the periphery of the piston by the pair of longitudinal slots 5 and transverse slot 6, which adjoins the slots 5 adjacent the solid end 1 of the piston, said slots at their opposite ends continuing to the lower end 7 of the piston. The cut out portion 4 is held in its peripheral position by a pair of integrally formed connecting portions 8^a, each of said portions extending from each of the wrist pin bearings 3.

Formed in the piston periphery opposite to the cut out portion 4 is a tongue shaped portion 8, having its free end extend adjacent the solid end 1 of the piston, said tongue portion being separated from the body portion 2 of the piston by a pair of longitudinal slots 9 and a transverse slot 10, said slots 9 at their lower ends terminating at a distance from the end 7 of the piston.

From the aforesaid detailed construction of this improved piston, the body portion 2 thereof having the cut away portion 4 and tongue shaped portion 8 formed therein, will be resilient, as against the ordinary type of piston, and inasmuch as the exploding impulses of internal combustion motors are effective on the solid heads of the pistons, a higher temperature will be given to the solid piston end or head, as against the body portion of the piston on which is contained the cylinder engaging portion.

In this connection, with applicant's improved construction, since the body portion 2 or cylinder engaging portion has separated portions, independent contracting and expanding extents can be carried out in the piston between the body portion 2 and the solid head 1 of the piston.

Inasmuch as the cut out portions provide resiliency to the body portion 2 of the piston, in order to take care of the greatest amount of expansion of the solid head of the piston, the periphery of the piston adjacent the solid head is made smaller in diameter than the remaining portion of the piston, as designated at 11, as the piston rings when mounted in the recesses 12 will provide the cylinder fit for the solid head 1, whereas the cut out portion 4 and tongue shaped portion 8 of the body portion 2 of the piston will yieldingly bear against the cylinder wall.

In addition to the aforesaid, in the operation of this improved piston, when the piston is driving the connecting rod downwardly on the line 13, and in the direction of the arrow 14 in Fig. 4, the forcing thrust of the piston on the connecting rod is received by the connecting portions 8^a and borne by the cut away portion 4 against the cylinder wall, thereby relieving the remaining portions of the piston from the thrust, and hence forth preventing bending strains being carried to the tongue shaped portion 8, and consequently preventing back slap of the piston.

What I claim is:

1. A one piece piston having a portion entirely separated and unsupported from its peripheral face, between the wrist pin bearings thereof, the peripheral wall of said

piston which is oppositely disposed from said separated portion being slotted.

2. A piston having a portion separated and unsupported from its peripheral face, and a cut out tongue shaped portion formed in the periphery of said piston oppositely disposed from said separated portion.

3. A piston having a portion separated and unsupported from its peripheral face, means for supporting said separated portion from the interior of the piston, and a cut out tongue shaped portion formed in the periphery of said piston oppositely disposed from said separated portion.

4. A one piece full skirted hollow piston having a portion of its peripheral face entirely cut away, between the wrist pin bearings thereof thereby forming a separated peripheral portion, and supporting means secured to said separated portion and the wrist-pin bearings of the piston, for holding said separated portion in peripheral alinement with the peripheral face of the piston.

5. A piston having a solid end portion and a full skirt portion formed integral therewith, and there being a part of said skirt portion entirely cut away and wholly unsupported from the main body portion thereof.

6. A piston having a solid end portion and a skirt portion formed integral therewith, there being a part of said skirt portion entirely cut away and wholly unsupported from the main body portion thereof, and there being a tongue shaped portion formed in said skirt portion.

7. A hollow piston having a portion of its peripheral wall entirely cut away between the wrist pin bearings thereof, thereby forming a separated section, said peripheral wall bearing a slot in opposite disposition to said section and supporting means secured to said section and the wrist pin bearings of the piston for holding said section in alinement with the peripheral wall.

8. A full skirted one piece piston having a portion of its peripheral wall entirely cut away and wholly separated from the remaining portion of the peripheral wall, said cut away portion being integrally supported from the interior of the piston.

9. A one piece piston having a pair of slots cut entirely through the thickness of its peripheral wall, said slots leading from the open end of the piston to a point adjacent the lowermost packing ring recess thereof and being joined by a transversely extending slot thereby forming a disconnected portion, and integral means provided for supporting said disconnected portion between said slots.

ELMER C. LONG.

[fols. 1735-1788] **DEFENDANTS' EXHIBIT 4-H(15).**

Prior Art Patent.

U. S. Patent No. 1,872,772, Aug. 23, 1932,

To E. C. Long.

Piston for Internal Combustion Motors.

(Filed January 27, 1934.)

717

Aug. 23, 1932. E. C. LONG 1,872,772

PISTON FOR INTERNAL COMBUSTION MOTORS

Filed March 7, 1919

Fig. 1.

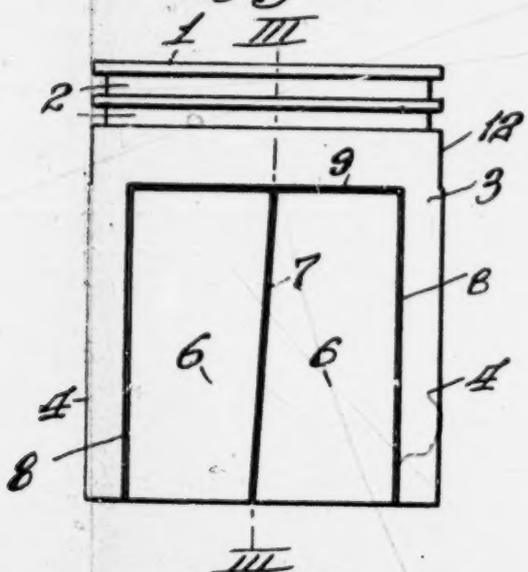


Fig. 2

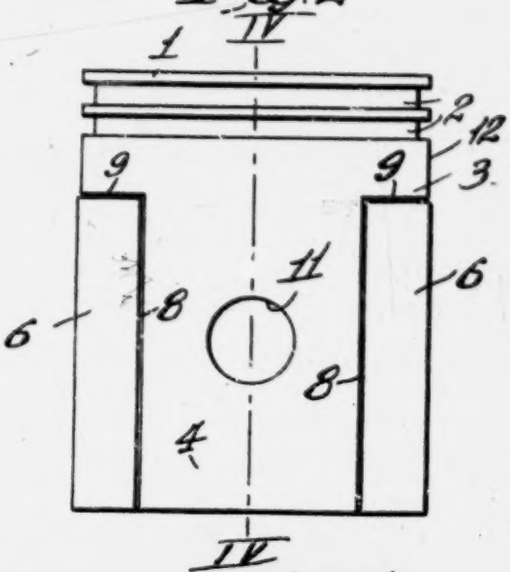


Fig. 3.

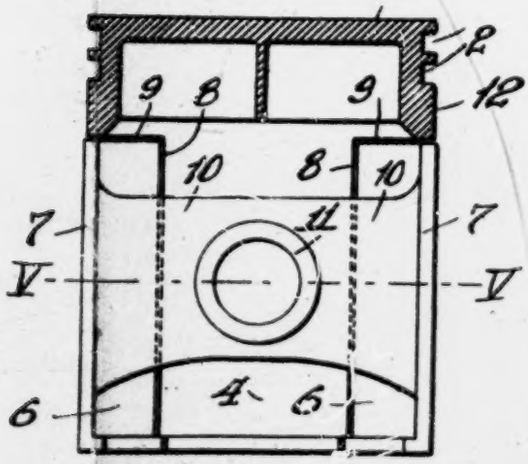


Fig. 4.

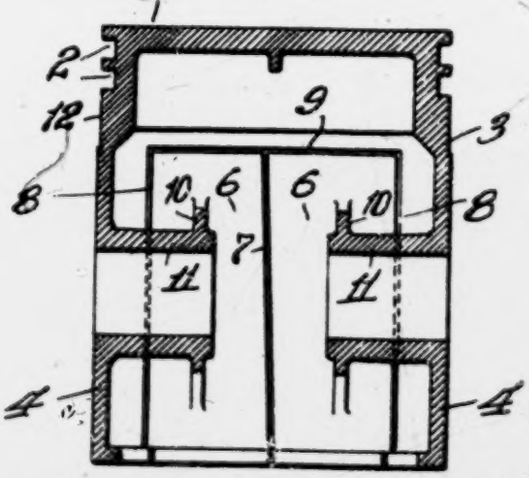
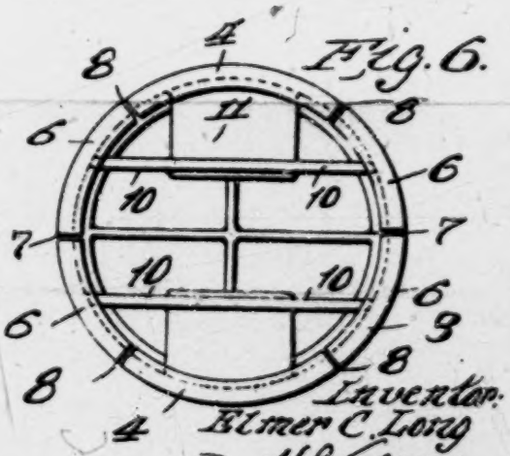


Fig. 5.

Fig. 6.



Inventor.
Elmer C. Long
By H. B. Hatcher
atty.

718

Patented Aug. 23, 1932 1,872,772

UNITED STATES PATENT OFFICE

ELMER C. LONG, OF QUINCY, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO SECURITY TRUST COMPANY, OF DETROIT, MICHIGAN A CORPORATION OF MICHIGAN

PISTON FOR INTERNAL COMBUSTION MOTORS

Application filed March 7, 1919. Serial No. 281,175.

The primary object of this invention is to provide an improved piston for internal combustion motors, whereby a better working relation is established between the piston and its cylinder during the operation of the motor under highly heated conditions.

Another object is to provide an improvement in a piston whereby the working thrust due to the piston forcing the connecting rod is received by certain parts of the piston only.

A further object is in providing an improved piston with means formed on that portion thereof which will engage the cylinder wall, whereby a better fitting relation can be given to the piston relative to the cylinder during the machining of the piston so that the fitting relation will be approximately the same during the operation of the motor in which this improved piston or pistons is contained.

Other and further objects will appear in the specification and be specifically pointed out in the appended claims, reference being had to the accompanying drawing exemplifying the invention, and in which,

Figure 1 is a side elevation of this improved piston.

Figure 2 is an elevation of the wrist pin side of the piston.

Figure 3 is a vertical section taken on the line III—III of Fig. 1.

Figure 4 is a vertical section taken on the line IV—IV of Fig. 2.

Figure 5 is a horizontal section taken on the line V—V of Fig. 3.

Figure 6 is an elevation of the lower end of the piston.

Referring to the drawing, 1 designates the solid end portion of the piston, having the usual piston ring recesses 2 and the main body portion 3, said main body portion having opposing wrist pin bearing sides of faces 4.

Formed in the periphery of the piston and in the body portion 3 thereof between the wrist pin side portions 4 and on each side of the piston is a pair of separated portions 6, said pairs of portions 6 being divided by a slanting or inclining slot 7, and are further divided from the body portion of a piston by the vertical slots 8 and the transverse slot 9.

Each cut out portion 6 is held in its peripheral position by an integrally formed connecting portion 10, there being a pair of said connecting portions extending in opposite directions from each of the wrist pin bearings 11.

In the construction of this improved piston, the slots 7, 8 and 9 which form the separated portions 6 are preferably cut in the body portion 3 of the piston, and in the machining of the piston the upper portion thereof adjacent the solid end 1 is turned to a lesser diameter than the body portion 3, as indicated by the numeral 12.

In setting forth the advantages gained by a piston of this improved construction, it will be necessary to call attention to the solid piston construction, in which the piston was turned down to a size considerably smaller than the diameter of the cylinder to allow for the expanding of the piston, the fit of the cylinder being provided by the piston or packing rings, but from experience, it has been found that the pistons of internal combustion engines would at the time have too great an expansion, whereby considerable friction was created on account of the piston fitting too tightly in the cylinder when the same became highly heated, and if the piston were turned down to a smaller diameter to avoid the extreme expanding fit of the piston during the highly heated condition, the piston would be too loose in the cylinder under normal conditions, thereby providing the piston with considerable back slap against the cylinder wall. With this improved construction, on account of the separated portions 6 provided in opposite disposed relation in the peripheral face of the piston, the body portion 3 thereof can be turned to a size slightly less in diameter than the cylinder wall so that when a motor equipped with this improved piston is put in operation, the proper fit is provided between the body portion of the piston and its cylinder under a small degree of heat, whereas when highly heated conditions exist the body portion of

the piston comprised of the wrist pin sides 4 and separated portions 6 can expand without fitting too tightly against the cylinder wall, as the expansion thereof will be taken up by the slots 7 and 8, as expanding and contracting resiliency is given to the body portion 3 of the piston by the separated portions thereof.

The expanding fit given to the body portion 3 of the piston as just related will allow the upper portion of the piston adjacent the solid end 1 to be turned to a lesser diameter as indicated at 12 on account of the fact that a proper packing and fitting relation is provided when the piston rings are mounted in their respective recesses 2, as said upper portion of the piston will be turned down to such a degree whereby the extreme expansion of the piston will not cause the peripheral face of the upper portion of the piston to engage the cylinder wall at any time.

In addition to the connecting portions 10, supporting their respective separated portions 6 of the piston, said connecting portions 10 serve to reinforce said separated portions 6 and hold them outwardly against the forcing thrust of the connecting rod so that back slap of the piston is prevented as it is to be noted that said separated portions 6 are angularly arranged relative to the wrist pin bearings 11 of the piston.

Inasmuch as the separated portions 6 will be rigidly held against bending against the forcing thrust of the piston from the connecting rod of the piston, the dividing slanting slots 7 of the pairs of separated portions 6 will prevent the wearing of a raised portion in the cylinder wall.

What I claim is:

1. A one piece piston having a solid walled skirt portion, said skirt portion having a pair of sections of its peripheral wall entirely cut away thereby forming separated peripheral parts, and integral means for supporting said sections in peripheral alinement with the peripheral face of said skirt portion.

2. A piston having a solid walled skirt, said skirt having a pair of opposing portions of its peripheral wall entirely cut away, thereby forming separated peripheral porportions, and integral supporting means secured to said separated portions and the wrist pin bearings of the piston for holding said separated portions in peripheral alinement with the peripheral face of the skirt.

3. A one piece piston having a full skirt portion, said skirt portion having opposing pairs of sections entirely cut away and wholly separated from its peripheral face, said sections being extended to one end of the piston.

4. A piston having a solid end portion and a skirt portion which is adapted to engage the entire circumferential wall of the cylinder in which it reciprocates, said skirt portion having a series of sections which are wholly separated from one another, said skirt portion having a pair of wrist pin bearings formed integral therewith, and a rib extending from each of said bearings to a respective section.

5. A piston having a head and a cross-head structure connected thereto and comprising diametrically opposite slippers, wrist pin bosses between the slippers and means joining said bosses and slippers together, the said joining means being resiliently yieldable.

6. In a piston for an internal combustion engine, the combination of a piston head having a depending ring flange, two pairs of curved guide members oppositely disposed with relation to the axis of the piston, the curved members of each pair thereof being separated from the ring flange and from each other by continuous air gaps, and webs carrying wrist pin bosses, the said curved members, piston head and webs being united in an integral unitary structure.

7. In a piston for an internal combustion engine, the combination of a piston head having a depending ring flange, two pairs of curved guide members oppositely disposed with relation to the axis of the piston, the curved members of each pair thereof being separated from the ring flange and from each other by continuous air gaps, wrist pin bosses and webs connecting the wrist pin bosses with certain of said guide members, said guide members, piston head and webs being united in an integral unitary structure.

ELMER C. LONG.

[fols. 1789-1796] **DEFENDANTS' EXHIBIT 4-H(25).**

Prior Art Patent.

U. S. Patent No. 1,557,625, Oct. 20, 1925,

To L. M. Stellman.

Piston Construction.

(Filed January 27, 1934.)

721

Oct. 20, 1925. 1,557,625

L. M. STELLMANN

PISTON CONSTRUCTION

Filed April 18, 1922 2 Sheets-Sheet 1

Fig. 2.

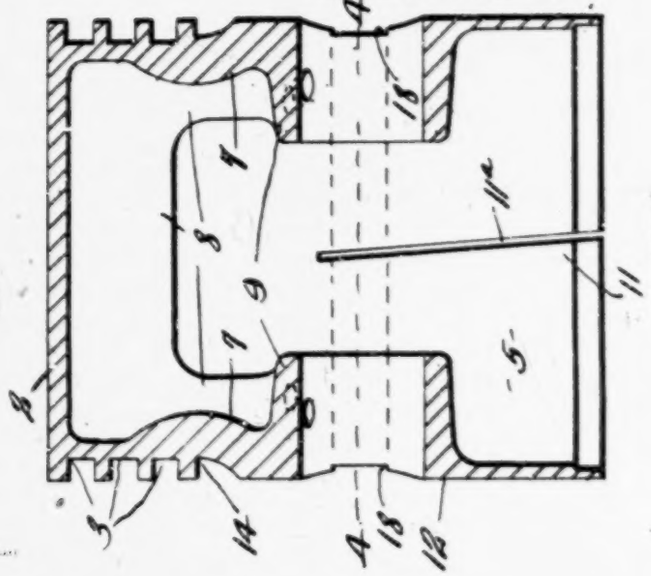
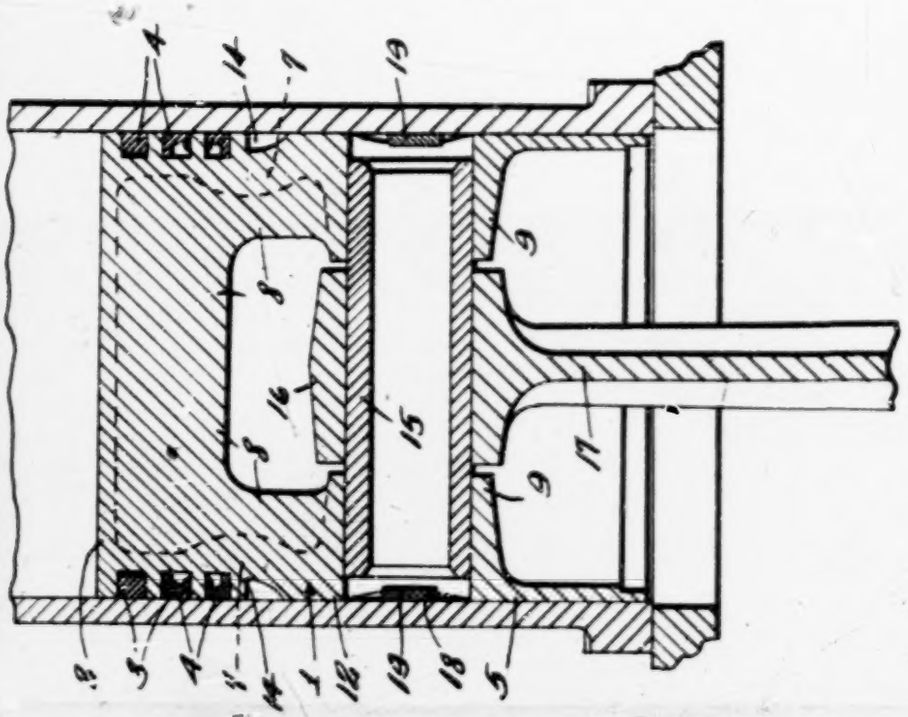


Fig. 1.



Louis M. Stellmann INVENTOR.

BY

Parsons & Bordell. ATTORNEYS.

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722

Oct. 20, 1925.

1,557,625

L. M. STELLMANN

PISTON CONSTRUCTION

Filed April 18, 1922

2 Sheets-Sheet 2

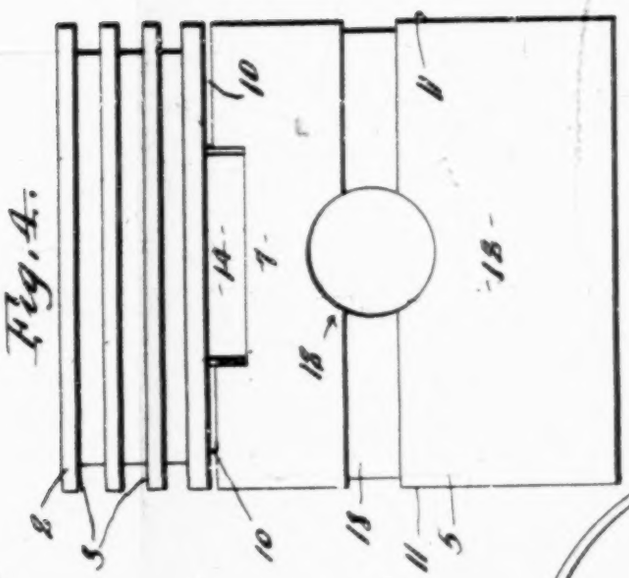

Fig. 4.

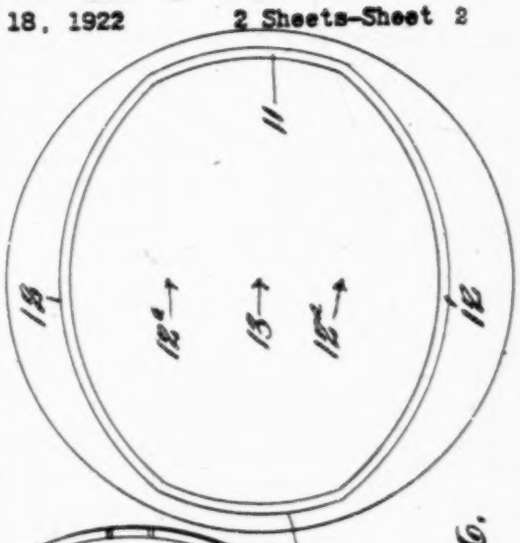

Fig. 6.

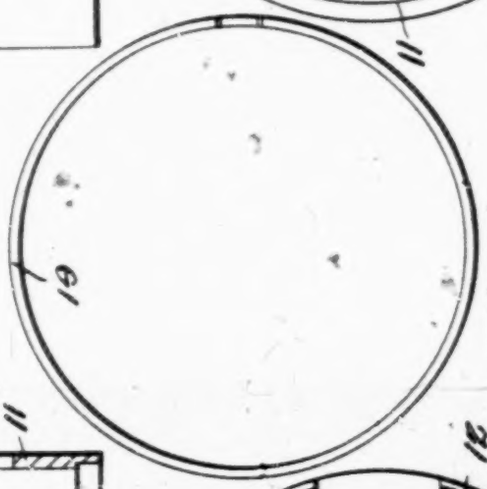

Fig. 7.

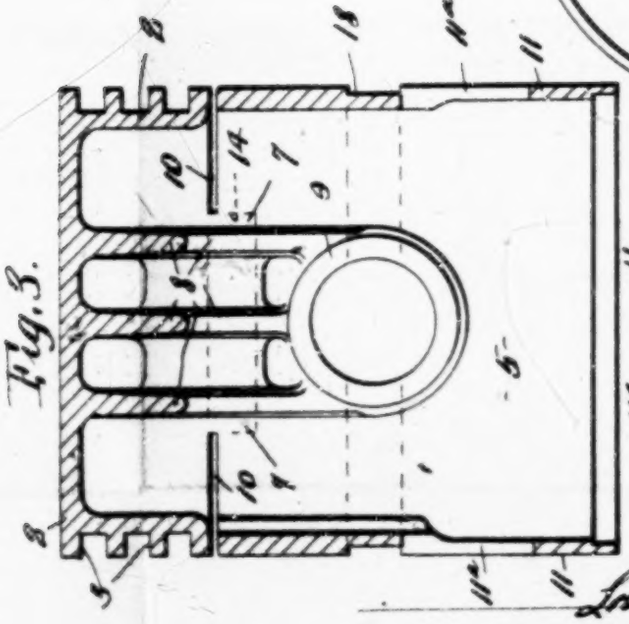

Fig. 3.

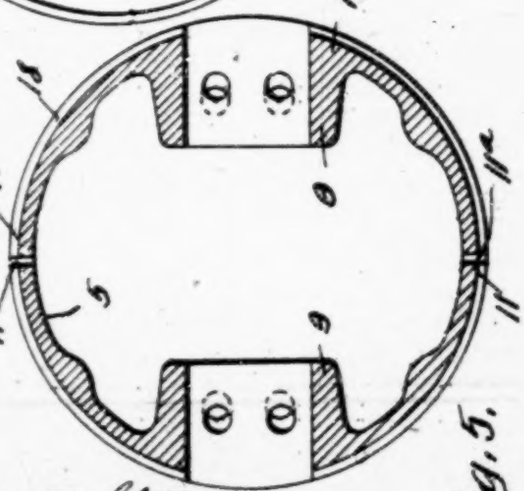

Fig. 5.

Louis M. Stellmann INVENTOR.

BY

Parmelee & Bissell ATTORNEYS.

Patented Oct. 20, 1925. 1,557,625

UNITED STATES PATENT OFFICE.

LOUIS M. STELLMANN, OF SYRACUSE, NEW YORK, ASSIGNOR TO H. H. FRANKLIN MANUFACTURING COMPANY, OF SYRACUSE, NEW YORK, A CORPORATION OF NEW YORK.

PISTON CONSTRUCTION.

Application filed April 18, 1922. Serial No. 554,748.

To all whom it may concern:

Be it known that I, LOUIS M. STELLMANN, a citizen of the United States, and a resident of Syracuse, in the county of Onondaga and State of New York, have invented a certain new and useful Piston Construction, of which the following is a specification.

This invention relates to pistons more particularly for internal combustion engines, which pistons are formed of a metal as aluminum alloy, having a greater coefficient of expansion than the cylinder walls which are usually of cast iron; and has for its object an expansible piston having a portion of its skirt or sleeve filling and conforming to the cylinder at all temperatures of the engines and other portions of its sleeve or skirt normally spaced apart from the cylinder walls and movable or expansible outwardly toward the cylinder walls to conform to the curve thereof, as the piston expands under the influence of the heat generated in the operation of the engine, the expansible portions carrying the wrist pin bosses and constituting approximately two-thirds of the cylinder.

The invention consists in the novel features, and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figure 1 is a fragmentary vertical sectional view of this piston, the contiguous portion of the cylinder and also the wrist pin and connecting rod and other parts of the engine being also shown, the connecting rod being broken away at one end.

Figure 2 is a sectional view of the piston similar to that shown in Fig. 1, the cylinder and other parts of the engine being omitted.

Figure 3 is a sectional view of the piston taken at a right angle to Fig. 2.

Figure 4 is an elevation of the piston.

Figure 5 is a transverse sectional view through the piston on line 4—4, Fig. 2.

Figure 6 is a diagrammatic view illustrating the position of the piston in the cylinder, the eccentric or expansible portions or walls of the piston being exaggerated to clearly illustrate the operation or expansion of the piston relatively to the cylinder.

Figure 7 is a detail view of the ring for holding the wrist pins from displacement.

This piston comprises a head portion provided with the usual grooves for the piston rings, and a sleeve, the sleeve having diametrically opposite eccentric expansible portions extending in arcs of greater radius than the normal radius or the radius of diametrically opposite concentric portions of the piston arranged between the expansible portions.

The concentric portions are arranged on the bearing or thrust sides of the piston and are of considerably less width than the eccentric portions, and the pin bosses are carried by the eccentric expansible portions.

1 designates the piston having a head 2 provided with the usual grooves 3 for the piston rings 4.

5 is the sleeve of the piston which is connected to the head by diametrically opposite integral portions at 7 and also by internal brackets or webs 8, the connecting portions 7 and webs 8 being located above the pin bosses 9.

The sleeve is also separated from the head by slots 10 located on diametrically opposite sides thereof on opposite sides of the connecting portions 7 and webs 8.

The sleeve 5 is automatically expansible to fit the cylinder and has concentric portions 11 on diametrically opposite sides thereof which slidably fit the bore of the cylinder and other diametrically opposite eccentric portions 12 between arcs of greater radius than the radius of the concentric portions and the center of the arc of each eccentric portion being located at 12^a on the opposite side of the longitudinal axis 13 of the piston from that on which the eccentric portion 12 is located.

In the interest of brevity, the piston thus may be considered to be slightly elleptical in general form in cross section although it is not a true ellipse as its ends are concentric with the axis of the piston and the outline of the piston is not a true ellipse.

The concentric portions 11 are arranged on the bearing or thrust sides of the piston

and each constitutes approximately one-sixth of the sleeve, and the wrist pin bosses 9 project inwardly from the intermediate portions of the eccentric sides of the piston, each of which constitute approximately one-third of the sleeve.

The outer faces of the sleeve are slightly tapered toward the lower end of the piston as indicated in Fig. 5.

Preferably, the concentric portions 11 of the piston are formed with lengthwise slots 11ª opening through the lower end of the piston and extending to a point above the axis of the pin bosses.

The piston is shown as provided with peripheral recesses 14 on diametrically opposite sides thereof in the connecting portion 7 in line with the slots 10. These recesses perform no function in the use of the piston but are present for manufacturing purposes for the purpose of facilitating the cutting of the slots 10 by turning operation.

The slots 10 entirely separate the concentric end portions or walls of the sleeve from the head and partly separate portions of the eccentric walls on opposite sides of the connecting neck 7 from the head.

The wrist pin bosses 9 as before stated, are carried by the eccentric or expansible portions on walls 12 of the sleeve and hence move radially during the expansion of such walls, and the wrist pin 15 is slidably or floatingly mounted in the wrist pin bosses and it is also preferably slidingly or floatingly mounted in the bearing 16 of the connecting rod 17.

In order to prevent the wrist pin from sliding into engagement with the cylinder walls and scoring the cylinder, the piston is provided with means for holding the pin from axial displacement beyond the periphery of the piston.

In the illustrated embodiment of my invention, the sleeve is formed with a circumferential groove 18 which extends across the outer ends of the wrist pin bosses, and a retaining ring 19 is seated in the groove and thus prevents outward movement of the wrist pin.

In case the piston pin becomes broken in use the ring 19 holds the fragment thereof from dropping down into the engine base and damaging other parts of the engine.

In operation, the piston is placed in the cylinder with the concentric portions 11 fitting the bore of the cylinder and holding the piston from slapping. As the piston becomes heated, the eccentric portions 12 thereof expand or bow outwardly toward or into continuations of the arcs of the concentric portions 11 and relieve undue tightness between the concentric portions 11 and the cylinder walls.

This piston construction is particularly advantageous in pistons made of aluminum or aluminum alloy or some metal having a greater coefficient of expansion than the cylinder, in that the piston is made to fit the cylinder at all temperatures of the engine, without relying upon resiliency of the metal. Hence, the liability of a resilient metal taking a permanent set is eliminated as in compressible pistons which sooner or later take a permanent set, and become sloppy.

What I claim is.

1. A piston for internal combustion engines comprising a head and a sleeve, the sleeve being slightly elliptical in general form in cross section, and the sleeve being formed with longitudinal slots arranged in the end walls of the elliptical form, the sleeve having pin bosses extending inwardly from the long walls of the elliptical form along a short diameter of the elliptical form and each of the long walls of the ellipse being approximately one third of the sleeve, substantially as and for the purpose specified.

2. A piston for internal combustion engines comprising a head, and a sleeve, the sleeve having diametrically opposite portions of its wall of equal width concentric with the axis of the piston and other diametrically opposite eccentric expansible portions between the concentric portions having their outer faces of greater radius than the concentric portions and located within continuations of the arcs of the outer faces of the concentric portions, each eccentric portion constituting approximately one-third of the sleeve, the concentric portions being formed with lengthwise slots opening through the lower end of the sleeve, and pin bosses projecting inwardly from the eccentric portions substantially midway between the concentric portions, substantially as and for the purpose specified.

3. A piston for internal combustion engines, comprising a head, and a sleeve, the sleeve having diametrically opposite portions of its wall of equal width concentric with the axis of the piston and other diametrically opposite eccentric expansible portions between the concentric portions, the eccentric portions having their outer faces of greater radius than the concentric portions and located within continuations of the arcs of the outer faces of the concentric portions, each eccentric portion constituting approximately one-third of the sleeve, the concentric portions being formed with lengthwise slots opening through the lower end of the sleeve, and pin bosses projecting inwardly from the eccentric portions substantially midway between the concentric portions, the slots being located in the portion of the sleeve at the end of the ellipse approximately midway between the pin bosses.

4. A piston for internal combustion en-

gines having a head and a sleeve, transverse slots in diametrically opposite sides of the piston separating the opposite side portions of the head from the sleeve, whereby the head is connected to the sleeve between the ends of the slots, the sleeve being slightly elliptical in general form in cross section, the ends of the elliptical form being concentric with the axis of the piston, and wrist pin bosses projecting from the portions of the sleeve joined to the head between the ends of the slots, the axis of said pin bosses extending along the short diameter of the elliptical form, substantially as and for the purpose specified.

5. A piston for internal combustion engines having a head and a sleeve, transverse slots in diametrically opposite sides of the piston separating the opposite side portions of the head from the sleeve, whereby the head is connected to the sleeve between the ends of the slots, the sleeve being slightly elliptical in general form in cross section, the ends of the elliptical form being concentric with the axis of the piston, and wrist pin bosses projecting from the portions of the sleeve joined to the head between the ends of the slots, the axis of said pin bosses extending along the short diameter of the elliptical form, the sleeves being also formed with lengthwise slots midway between the ends of the transverse slots, substantially as and for the purpose set forth.

In testimony whereof, I have hereunto signed my name, at Syracuse, in the county of Onondaga, and State of New York, this ----day of February, 1922.

LOUIS M. STELLMANN.

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[fols. 1797-1802] **DEFENDANTS' EXHIBIT 4-H(26).**

Prior Art Patent.

U. S. Patent No. 1,842,022, Jan. 19, 1932,

To S. D. Hartog.

Piston.

(Filed January 27, 1934.)

727

Jan. 19, 1932. S. D. HARTOG 1,842,022

PISTON

Filed Feb. 16, 1920

Fig. 1

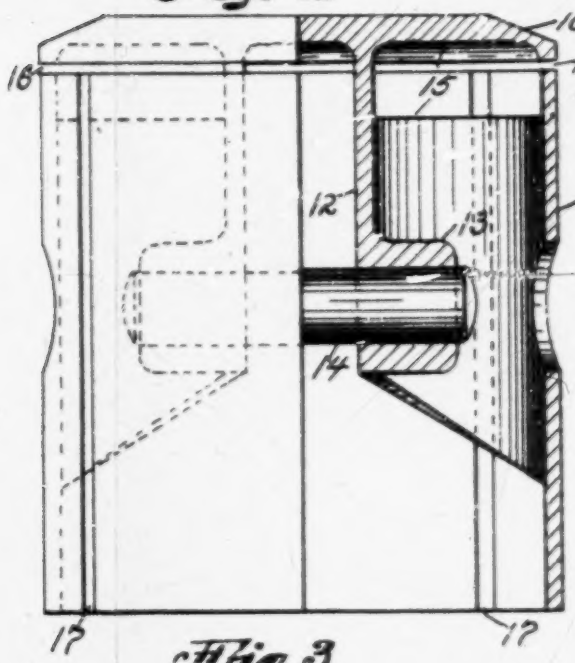

Fig. 2

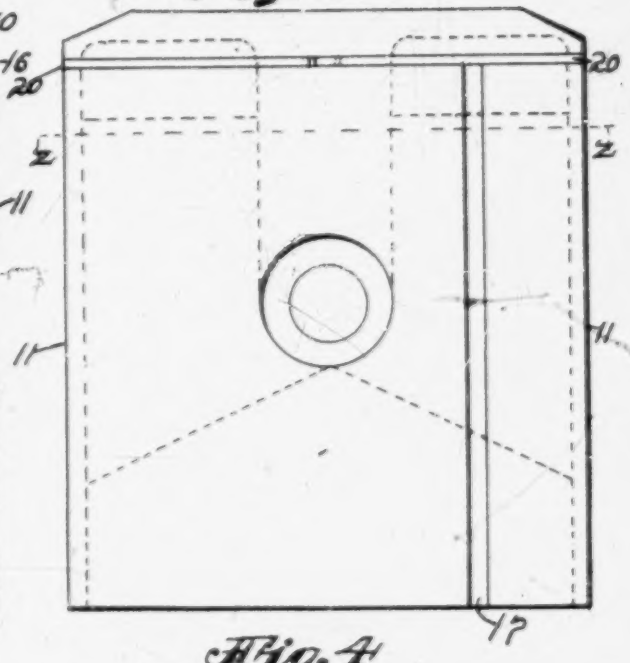

Fig. 3

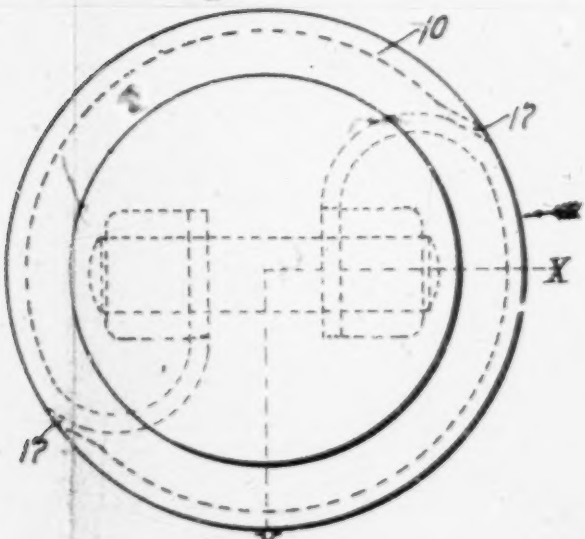

Fig. 4

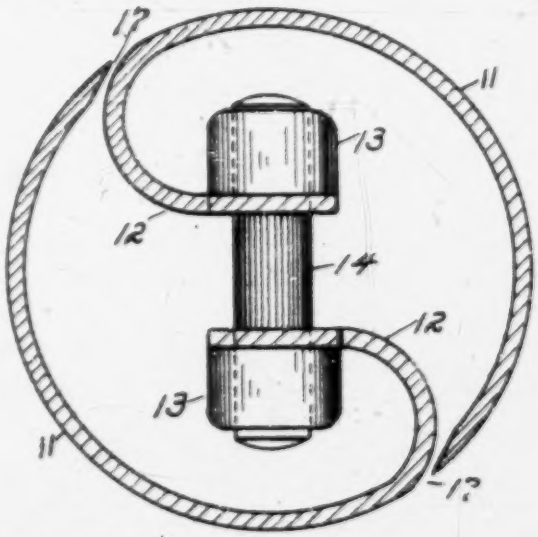

Fig. 5

Fig. 6

Inventor
Stephen D. Hartog

Patented Jan. 19, 1932 1,842,022

UNITED STATES PATENT OFFICE

STEPHEN D. HARTOG, OF ST. LOUIS, MISSOURI, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE CLEVELAND TRUST COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO

PISTON

Application filed February 16, 1920. Serial No. 359,137.

This invention relates to piston, more particularly to pistons for use in internal combustion engines.

The piston is the movable member within the cylinder of the engine and in the internal combustion engine the head portion of the piston is subjected to direct contact with the high heat temperature caused by the frequent explosions of the ignited gases. The piston unlike the cylinder is not provided with means for cooling or controlling its temperature and the head portion thereof, quite frequently attains a temperature of 750 to 1000 degrees Fahrenheit. This heat temperature causes the piston to expand and this expansion of the piston is greater than that of the cylinder in which it operates, consequently, the piston must be smaller in diameter than the diameter of the bore of the cylinder to admit of its expansion allowing the piston movable action in the cylinder free from binding, which would otherwise occur were the piston made to a size to fit the cylinder when cold.

The head portion of the piston receives its heat by direct contact, the body portion by transmission, the head portion therefore must be made smaller than that of the body portion.

The piston as thus made would yet be unsuccessful operatively if it were not for the use of split metallic packing rings employed solely to pack the space between the piston and the cylinder and ordinarily positioned in grooves cut in the head section of the piston. The piston as ordinarily made with grooves and packing rings therein lack the requisite features of a more desirable construction in that the looseness of the piston tends to wear the cylinder out of cylindrical truth. The delicate structure of the rings causes them to lose their tension due to the high heat temperature to which they are subjected, consequently, failing in their function to properly pack the cylinder against leakage, causing loss of compression, also permitting the lubricating oil not only to enter the combustion chamber resulting in irregular ignition, but also permitting lubricating oil to secrete beneath the rings between their inner surface and the bottom of the grooves resulting in the formation of carbon therebetween causing a solid mass to form which forces the rings against the cylinder wall and not infrequently results in scoring the cylinder.

The present invention is designed to overcome all of the objections above described and as inhering in the prior art construction, by constructing the piston in such a novel way as will eliminate the objections referred to and to such ends the invention comprises a piston having a head and body free from ring grooves. The head and body united by suitable ribs constructed in a manner providing a yielding capacity. The body of the piston being parted from the head and a slit or series of slits cut through the body and terminating at the parting between the head and the body. Sealing means for the head and body and positioned in the space therebetween.

The object therefore, of the present invention is to construct a piston free from rings and ring grooves, a piston made the reverse of present practice in that it is initially larger in diameter than the diameter of the bore of the cylinder, a piston characterized by the feature of being expansible and contractable automatically under the varying condition to which it is subjected, a piston enabled, by its construction, to fit the cylinder snugly at all times.

For the purpose of enabling others to clearly understand, make, and operate this invention the following description is given supplemented by the accompanying drawings, in which:

Figure 1 is a vertical elevation partly in section as of the line X—X Figure 3.

Figure 2 is a vertical side elevation viewed in the direction indicated by the arrow Figure 3.

Figure 3 is a plan view.

Figure 4 is a plan view in section of Figure 2 as of the line Z—Z Figure 2.

Figure 5 is a fragmentary view in elevation of a member part of this construction.

Figure 6 is a side view of Figure 5.

In the drawings like numerals of reference indicate corresponding parts throughout the several figures. The numeral 10 designates

the head portion of this construction, 11 the body portion, the portions 10 and 11 are united integrally by internal ribs 12 a portion of which has an intersection integrally with the head 10 and the other portion extends radially and has its intersection with the body 11. The ribs 12 have bosses 13 f med thereto which are drilled or bored to receive a pin 14 which connects the piston with the other operable parts of the engine. The ribs 12, are especially constructed to support and unite the head 10 and the body 11 and also to support bosses 13, experience has proven this construction to have an advantage in that of preventing distortion of the body 11, due to the stresses to which a piston is subjected by reason of the angularity of the different positions of the connecting rod while the engine is in operation. The ribs 12, in this case carry the parts connecting the piston with the engine more yieldingly than would be the case were the bosses 13 directly supported by the body 11, resulting in a more smoothly running engine having less vibration. The radially extending portion of the r. 12, is not connected with the head 10, there being a space 15, between the under side of the head 10, and the upper end of the ribs 12, this permits the U shaped cross section of the ribs 12, to have a yielding effect when in operation both in lateral and circular direction, that is to say the body 11, will yield diametrally and circularly when subjected to pressure from the sides.

In the manufacture of this improved construction of piston the head 10, the body 11, with ribs 12, and bosses 13, are cast to form from cast iron or suitable alloy composition metal the hole in the bosses 13, for the connecting pin 14, is cored to approximately the size to which it is finally to be finished the cored hole extending through the body 11, in alignment with the hole in the bosses 13, the space 15, between the under side of the head 10, and the top of the radial portion of the ribs 12, is also cored at the time of casting the entire body. The external surface of the head 10, and the body 11, is subjected to a machining process for the purpose of dressing the head 10, and to size the body 11, so that it will properly fit into the cylinder. At this point a change is made just the reverse of that which is the practice in sizing the conventional type of pistons for instead of machining the body of the piston smaller than the bore of the cylinder into which it is to operate, as is the common practice, my improved piston is machined to a size approximately of .005 of an inch larger than the bore of the cylinder.

When the head 10, and body 11, are thus machined to size the head 10, and the body 11, are then parted from each other at 16, by using a very thin parting tool and cutting through the body 11, adjacent the head 10, a very thin opening 16, is effected parting the head 10, from the body 11.

The next operation is to cut very thin slits 17, adjacent the intersection of the radial ribs 12, with the body 11, cutting through the body 11, and longitudinal of its axis terminating at the parting 16, just beneath the head 10. The resulting consequences of this operation renders the body 11, resilient, that is, the body will yield radially and circularly so that it can be placed tensionally in a cylinder having a bore less in diameter than that to which the piston was sized.

The piston thus made will fit the cylinder very properly but it would not prevent the compression leakage or the escapage of gases through the parting at 16, between the edge of the head 10, and the edge of the body 11. T effect a seal at the parting 16, a thin sheet metal ring 18, Figures 5, and 6, is inserted into this space, this ring is split at 19, with lapping portions 20, one above the other for a distance of about ⅛ of an inch.

The function of the split metal ring 18, is to to seal the opening 16.

From the foregoing description it is clear that this construction fulfills the purpose for which it is intended. The body 11, being resiliently expansible and contractable renders the use of split metal piston rings unnecessary, doing away entirely with grooves cut in the piston for the rings, eliminating this source of danger to the cylinder by reason of the accummulation of carbon therein which tends to build up beneath the rings forcing them against the cylinder walls causing the scoring of the cylinder.

It is finally to be noted that the body portion 11, is turned to a size over its full length to an amount approximately .005 of an inch larger than the bore of the cylinder into which it is to operate. The effect of splitting the body 11, at diametrically opposite position as at 17, and assisted by the U shaped portion of ribs 12, provides the condition for uniform circular expansion and contraction of the body 11, effecting a uniform tensional fit in the cylinder.

It is understood that minor changes may be made in the size, form and shape of this structure without departing from the spirit of this invention within the scope of the appended claims.

Having thus described the invention what I claim and desire to secure by Letters Patent is:

1. A piston having its head and body integrally connected by means of internal yielding ribs, a parting between the head and body, slits cut through said body, sealing means for said head and body, and means provided on said internal ribs adapted to form engaging connection with operable parts for said piston.

2. A piston having internal yielding ribs

integrally connecting the head and body portions of said piston, said head and body portion being parted from each other, sealing means positioned in said parting between the head and body, slits cut through the body portion of said piston providing resiliency for said body and means provided on said internal ribs adapted to form engaging connection with operable parts for said piston.

3. In a piston of the class described, a cup-like head comprising a pressure receiving end and a wall portion, a skirt circumferentially disconnected from the wall portion of the head and divided from end to end, and skirt carriers connecting said skirt to the pressure receiving end, said skirt carriers being disconnected from the wall portion of the head and susceptible of being slightly flexed radially.

4. A piston comprising a head, a skirt having resilient sections separated from said head by a slit extending continuously around the piston, and means for yieldingly connecting said skirt sections with said head.

5. A piston having a skirt at least a portion of which is separated from the head by a slot in which a piston ring is adapted to be mounted, said portion of the skirt being supported from the head by a flexible interior rib member.

In confirmation hereof I hereto attach my signature.

STEPHEN D. HARTOG.

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[fols. 1803-1834] **DEFENDANTS' EXHIBIT 4-H(27).**

Prior Art Patent.

U. S. Patent No. 1,499,073, June 24, 1924,

To L. H. Pomeroy.

Piston.

(Filed January 27, 1934.)

732

June 24, 1924. 1,499,073

L. H. POMEROY

PISTON

Filed Sept. 4, 1919

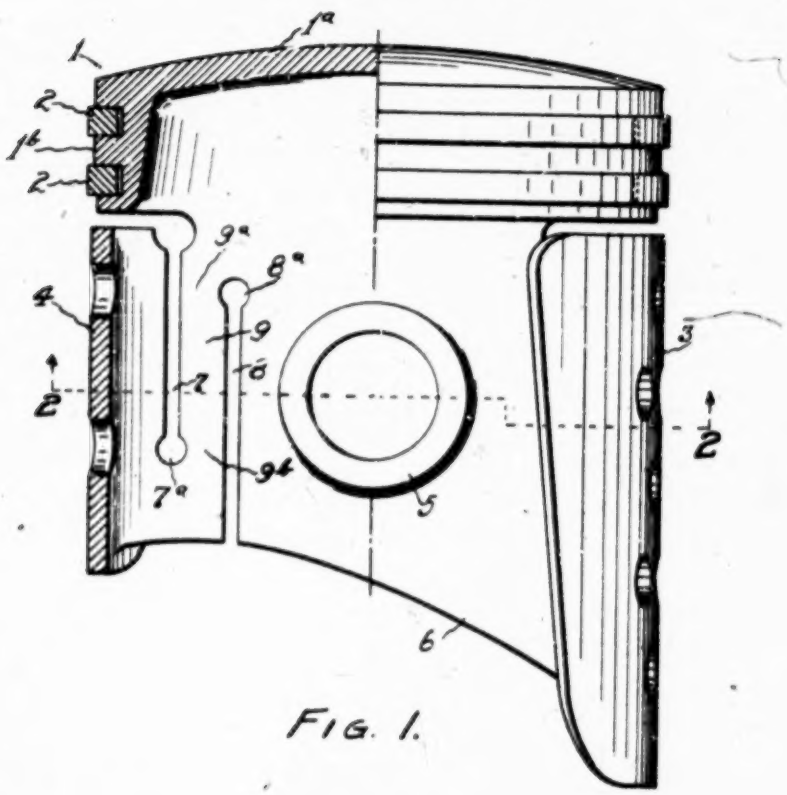

FIG. 1.

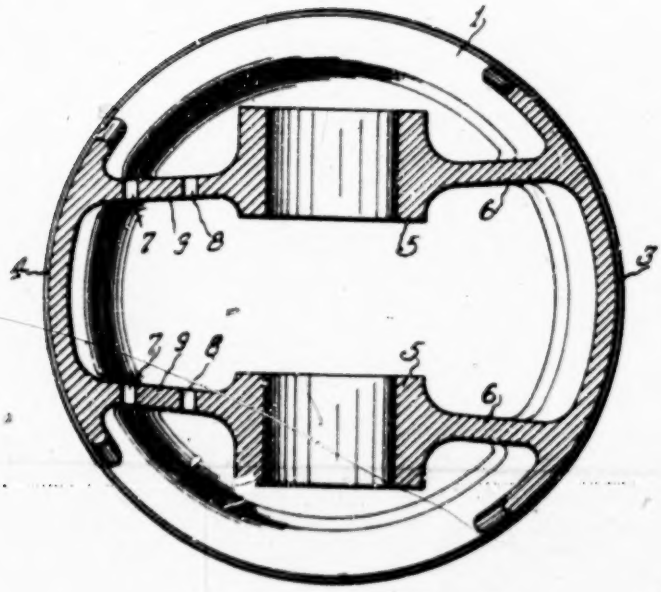

FIG. 2.

INVENTOR,
Laurence Henry Pomeroy
By Ray S. Sehr
his Attorney

Patented June 24, 1924. 1,499,073

UNITED STATES PATENT OFFICE.

LAURENCE HENRY POMEROY, OF CLEVELAND, OHIO, ASSIGNOR TO THE ALUMINUM COMPANY OF AMERICA, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PISTON.

Application filed September 4, 1919. Serial No. 321,696.

To all whom it may concern:

Be it known that I, LAURENCE HENRY POMEROY, a subject of the King of Great Britain and Ireland, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Pistons, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates more particularly to pistons adapted for use in internal combustion engines or under conditions in which the piston is subjected to considerable heat.

As is well known, the clearance with which the pistons of internal combustion engines are fitted is determined in a large measure by the difference in thermal expansion of the piston and the cylinder wall. This difference in thermal expansion is due to the fact that the working temperature of the piston is somewhat higher than that of the cylinder wall and, in some cases, to the use of different piston and cylinder materials having different co-efficients of thermal conductivity and expansion. Thus in the case of pistons of aluminum or magnesium alloys working in iron cylinders the co-efficient of expansion of the aluminum or the magnesium being higher than that of iron, it is necessary to give the pistons a larger clearance than is required for iron pistons working in iron cylinders. This larger clearance, with pistons as heretofore constructed, results in piston slap or knock when the engine is running cold at starting and, in fact, whenever the thermal conditions of the cylinder and piston are such that the large clearance required to obviate seizure at high temperatures exists between the piston and cylinder wall.

One object of the present invention is the provision of a piston of aluminum alloy or other light weight metal, that will operate without piston slap.

Another object of the invention is the provision of a piston so constructed that it can be given a small working clearance independent of differences of thermal expansion of the piston and the cylinder wall.

A further object of the invention is the provision of a piston capable of adjusting itself to the cylinder as wear occurs of the piston or cylinder or both.

Another object of the invention is the provision of a piston that will wear evenly from end to end.

Another object of the invention is the attainment of the ends above mentioned in an integrally cast piston.

These and other more or less incidental objects, are attained in the manner set forth in the following description of the preferred form of construction.

In the drawings,

Fig. 1 is a view partly in side elevation and partly in section of a piston embodying the invention.

Fig. 2 is a section on the line 2—2, Fig. 1.

My improvements are applicable to pistons of various forms of construction but in the drawings, for purposes of explanation, I have shown the invention applied to the slipper type of piston shown in United States Letters Patent No. 1,294,833, to H. R. Ricardo.

Referring in detail to the construction illustrated, the piston has a head section 1 comprising a crown 1^a and a side wall 1^b which is formed with grooves to receive suitable packing rings 2, 2. The guide section of the piston comprises diametrically opposite cylinder-engaging slippers 3 and 4, a pair of wrist pin bosses 5, 5 arranged between the slippers, and a pair of webs 6, 6 which join the slippers and bosses together and extend upward and merge with the crown and side wall of the head section of the piston, the entire piston being cast in one. Aside from the rings 2, 2, only the slipper parts 3, 4 are designed to contact with the cylinder wall, the piston differing in this respect from the prior trunk or skirted pistons which have a guide part in the form of a continuous sleeve or skirt that contacts with the cylinder wall on all sides.

In the construction shown the slippers 3 and 4 are made unequal in size, the larger slipper 3 being designed to take the angular thrust or reaction of the connecting rod during the explosion stroke of an internal combustion engine, while the smaller slipper 4 is designed to take the angular thrust during the compression stroke of the engine. The above described features of the construction are characteristic of the Ricardo slipper piston.

My improvements constituting the present invention are effected by forming the piston

so that some part of the guide structure is capable of resiliently yielding at points between the cylinder-engaging surfaces on opposite sides of the wrist pin to compensate for differences in thermal expansion of the piston and cylinder and I prefer to make the guide structure so that it will yield more readily between the wrist pin bosses and the cylinder-engaging surface which takes the thrust during the compression stroke of the piston, than between said bosses and the cylinder-engaging surface which takes the thrust during the explosion stroke. The means, when applied to the slipper type of piston illustrated, that the major yield shall occur between the pin bosses 5 and the cylinder-engaging surface of the slipper 4, and in the construction illustrated I have made provision for a resilient yielding in the webs 6, 6 which permits movement of the slipper 4 toward and from the slipper 3. To secure relative movement of the slipper 4 in parallelism, the web structure is formed to yield in two separated sections, which are preferably adjacent the respective ends of the slipper.

In the construction illustrated this is accomplished by forming each of the webs 6 with two parallel slots 7 and 8, the slot 7 being open at its upper end and closed at its lower end, while the slot 8 is closed at its upper end and open at its lower end. The slots 7 and 8 terminate at their closed ends with enlarged cylindrical aperatures 7^a and 8^a, respectively. Thus it will be seen that the slipper 4 is supported by elongated strips or sections 9 of the webs 6, and each of the sections 9 has reduced and weakened cross sections at 9^a and 9^b, so that any yielding of the web structure is localized at these points 9^a and 9^b.

My improved form of construction can be applied to pistons cast of any suitable metal but it is especially useful in connection with pistons of aluminum alloy or other light metals having high co-efficients of thermal expansion in comparison with iron as it makes it possible to fit such pistons with as small a clearance as is possible with iron pistons of prior forms of construction. Iron pistons of internal combustion engines fitted with a clearance of 0.00075 inch per inch of piston diameter are found to operate with substantial freedom from piston slap, and pistons of aluminum alloy made in accordance with my invention can readily be operated with similar clearances. Indeed a still smaller clearance is made possible by my invention.

In the operation of aluminum pistons of my improved form of construction, asuming a cold working clearance of 0.00075 inch per inch of piston diameter, or less, to insure freedom from piston slap when starting, as the engine heats up the excess expansion of the piston as compared with the surrounding cylinder wall of iron will reduce this clearance; but as the clearance approaches zero the construction of the piston webs permits them to yield so as to compensate for the excess expansion of the guide section of the piston and all danger of the seizing of the piston is obviated. When the engine is stopped and the parts again cool down the resilience of the web structure causes it to return to normal form and a suitable small clearance between the piston guide and the cylinder wall is maintained. It will, of course, be understood that the piston head proper is given a smaller diameter than the guide and does not function as a guide. As has been explained the yielding of the web structure occurs at the points 9^a and 9^b adjacent to the upper and lower parts of the slipper 4 so that the slipper 4 is maintained in parallelism with the axis of the cylinder. This insures uniform contact and wear throughout the full length of the slippers. As only a relatively light thrust, incident to the compression of the combustible charge in the engine cylinder, is applied to the smaller slipper 4, the resilient web structure is able to sustain the stresses to which it is subjected, it being possible, of course, to make the guide structure between the wrist pin bosses and the cylinder-engaging surface of the slipper 3 adequately strong to sustain the heavy thrust due to the explosion of the engine charge. This is an important feature of my invention since in most, if not all, cases it is found that a construction that is capable of yielding sufficiently to adequately compensate for differences of expansion, will fail if subjected to the angular thrust of the connecting rod in the working or explosion stroke of the piston.

It is to be understood that the dimensions of the yieldable web sections, as at 9^a and 9^b, will be determined by the diameter of the piston and other factors such as the compression pressure and the maximum engine speed, the requirements being that the web sections 9^a and 9^b yield sufficiently to prevent seizing under the pressure set up between the cylinder wall and the piston due to thermal expansion, but do not yield too much under the thrust due to compression and inertia, and that they yield, whether under said expansion pressure or under the thrust due to compression and inertia, in a manner to maintain the slipper 4 parallel to the piston axis.

It will be seen that the amount of yielding in the piston webs will be determined, for the most part, by the cold working clearance of the piston. By making this clearance sufficiently small the clearance will be rendered nil when the parts heat up in operation and a resilient pressure of the slippers against the cylinder wall will be secured.

Under these conditions the resiliency of the piston web structure will insure the maintenance of close working contacts between the slippers and the cylinder wall as wear of these parts occurs and, as above noted, the movement of the slipper 4 parallel to the piston axis will insure a uniform contact and wear of the parts throughout the full lengths of the slippers. In other words, my resiliently yieldable piston structure, by compensating for excess expansion of the piston, secures an automatic adjustment of the piston to the cylinder as wear occurs.

My improvements, while applicable in their broader aspects to other types of pistons, are especially applicable to the slipper type of piston illustrated and it will be seen that this is due, in part at least, to the fact that the yieldable web parts have no contact with the cylinder wall and thus are free, in so far as the cylinder is concerned, to accommodate themselves to the movement of those parts which do engage the cylinder.

It is obvious that my invention can be embodied in various forms of construction and it is to be understood that it is not limited to the particular construction illustrated in the drawing except as specified in the following claims.

What I claim is:

1. An integrally cast piston comprising a head, diametrically opposite guide slippers, a pair of wrist pin bosses between the slippers and a pair of webs joining the head, slippers and bosses together, said webs being formed at points between the bosses and one of the slippers so as to resiliently yield and permit movement of said slipper toward and from the other slipper.

2. An integrally cast piston comprising a head, diametrically opposite guide slippers, a pair of wrist pin bosses between the slippers and a pair of webs joining the head, slippers and bosses together, said webs being formed at points between the bosses and one of the slippers so as to resiliently yield and permit movement of said slipper in parallelism toward and from the other slipper.

3. An integrally cast piston comprising a head, diametrically opposite guide slippers, a pair of wrist pin bosses between the slippers and a pair of webs joining the head, slippers and bosses together, said webs being formed between the bosses and one of the slippers each with a pair of parallel slots of which one is open at its end adjacent the piston head and the other is open at its end away from said head.

4. A piston comprising a head and a guide structure connected thereto having wrist pin bosses and cylinder-engaging surfaces on opposite sides of the bosses, the guide structure being adapted to resiliently yield to a greater extent between the pin bosses and one of said cylinder-engaging surfaces than between the said pin bosses and the other cylinder-engaging surface.

5. A piston having a head and a guide structure connected thereto, said guide structure comprising diametrically opposite parts having cylinder-engaging surfaces, wrist pin bosses, between said opposite parts, and means for joining said bosses and cylinder-engaging parts, said joining means being arranged not to engage the cylinder and the guide structure being adapted to resiliently yield to a greater extent between the pin bosses and one of said cylinder-engaging surfaces than between the said pin bosses and the other cylinder-engaging surface.

6. A piston having a head and a guide structure connected thereto, said guide structure comprising diametrically opposite slippers having cylinder-engaging surfaces, wrist pin bosses between the slippers and means joining said bosses and slippers together, the guide structure being adapted to resiliently yield to a greater extent at points between the pin bosses and the cylinder-engaging surfaces of one slipper than between the said pin bosses and the cylinder-engaging surfaces of the other slipper.

7. A piston having a head and a guide structure connected thereto which comprises diametrically opposite cylinder-engaging parts, wrist pin bosses between the cylinder-engaging parts, and means joining said bosses and cylinder-engaging parts together, the said joining means being resiliently yieldable to a greater extent on one side of the wrist pin bosses than on the other side thereof.

8. A piston having a head and a guide structure connected thereto which comprises diametrically opposite slippers, wrist pin bosses between the slippers and means joining said bosses and slippers together, the said joining means being resiliently yieldable to a greater extent on one side of the wrist pin bosses than on the other side thereof.

9. A piston as claimed in claim 4 characterized by being integrally cast.

10. A piston as claimed in claim 5 characterized by being integrally cast.

11. A piston as claimed in claim 6 characterized by being integrally cast.

12. A piston as claimed in claim 7 characterized by being integrally cast.

13. A piston as claimed in claim 8 characterized by being integrally cast.

In testimony whereof, I hereunto affix my signature.

LAURENCE HENRY POMEROY.

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[fol. 1835] **DEFENDANTS' EXHIBIT 4-L.**

File Wrapper and Contents of Gulick Patent in Suit.

(Filed January 27, 1934.)

390

DEPARTMENT OF COMMERCE

UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

This is to Certify that the annexed is a true copy from the records of this office of the File Wrapper and Contents, in the matter of the Letters Patent of Edward J. Gulick, Assignor, by Mesne Assignments, to The Cleveland Trust Company, Number 1,815,733, Granted July 21, 1931, for Improvement in Pistons.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this fourteenth day of January, in the year of our Lord one thousand nine hundred and thirty-three and of the Independence of the United States of America the one hundred and fifty-seventh.

THOMAS E. ROBERTSON,
Commissioner of Patents.

(Seal)

ATTEST: D. E. WILSON,
Chief of Division.

(Old Wrapper with Record of Actions Inside)

Number (Series of [1925]* 1915) **1,815,733**

204661

PATENT No. 1815733

1917

Dated Jul 27 1931

Div. 12 (Ex'r's Book) 147-179-B

Name Edward J. Gulick

of
State of **(See jacket inside)**
Invention

Original	Renewed
Application filed complete , 19	
[fol. 1836] PARTS OF APPLICATION FILED	Certificate of Correction
Petition, Specification, Oath, First Fee $20, 1 sheets Drawings, , 19	September 22, 1931
Examined and passed for Issue May 16 1931 , 1931	Reexam'd and passed for Issue , 19
C. C. Henry Exr. Div. 12	Exr. Div.
Notice of Allowance May 16 1931	Notice of Allowance , 19
By Commissioner.	By Commissioner.
Ex cl $13.00	
Final Fee $25 June 18, 1931	Final Fee , 19
Ex cl $10.00 June 25, 1931	
Attorney	
Associate Attorney	**Slip**

No. of Claims Allowed 43 Print Claim[s]* 1 in O. G. Class 74-108.

Title as Allowed Piston

Division of App., No....., filed....., 19...

[*Matter enclosed in brackets struck out in copy.]

733 12426

($15 Rec'd Nov 30 1917 C. C. U. S. Pat. Office Ck a)

204661

Division 12, Paper No. 1

Dec 3 1917

U. S. Patent Office

PETITION

To the Commissioner of Patents:

Your Petitioner, Edward J. Gulick, residing at Elkhart, County of Elkhart, State of Indiana, and whose P. O. Address is P. O. Box 553, Elkhart, Indiana, prays that Letters Patent of the United States may be granted to him for the Improvement in Hydrocarbon Motors, set forth in the annexed specification; and he hereby appoints Milton Tibbetts, (Registration No. 5403), of the City of Detroit, County of Wayne, State of Michigan, his Attorney, with full power of substitution and revocation, to prosecute this application; to make alterations and amendments therein; to receive the patent, and to transact all business in the Patent Office, and [fol. 1837] before the Courts, D. C., connected with the application or with the patent granted thereupon, and to do all other lawful acts and things which he if personally present could.

EDWARD J. GULICK.

SPECIFICATION

To Whom It May Concern:

Be it known that I, Edward J. Gulick, a citizen of the United States, and resident of Elkhart, Elkhart County, State of Indiana, have invented certain new and useful improvements in [Hydrocarbon Motors]* **Pistons** of which the following is a specification:

[*Matter enclosed in brackets struck out in copy.]

1. 204661—1

MT:MEG 12427

B-1733

SB

per H This invention relates to [hydrocarbon motors **per H** and particularly to]* pistons [therefor.]*

Title change per C per H One of the objects of the present invention is to provide a piston which [is]* **will** not [adapted to]* expand against the cylinder wall to such an extent as to **seize** [sieze]* or stick.

per E Another object of the invention is to provide a piston with a skirt **or guide portion** slightly separated from the head of the piston and split longitudinally so that it will not expand in circumference with a force great enough to cause the piston to stick in the cylinder.

per E Another object of the invention is to provide a piston with **improved lubricating means for** [lubricating conduits leading from the exterior of the piston to]* the piston pin bosses.

Insert H¹ Another object of the invention is to rigidly support the piston pin bosses of a piston from the piston walls. **(4) H¹**

Other objects of the invention will appear from the following description taken in connection with the drawings which form a part of this specification, and in which:

Fig. 1 is a longitudinal sectional view through a piston embodying the invention;

Fig. 2 is similar to Fig. 1 taken at right angles thereto, being on the line 2—2 of Fig. 3;

[fol. 1838] Fig. 3 is a transverse section substantially on the line 3—3 of Fig. 1;

Fig. 4 is a transverse section on the line 4—4 of Fig. 1;

2. 204661—2

12428

Fig. 5 is a view similar to Fig. 1, showing a slightly different form of piston embodying the invention; and

Fig. 6 is a top view of the piston shown in Fig. 5.

[*Matter enclosed in brackets struck out in copy.]

Referring to the drawings, 10 represents the
Per E head **portion** of a piston and 11 is the skirt **or**
" E **guide portion** which is shown as separated at its periphery from the head leaving an annular slit or opening 12 therebetween. The head portion of the piston is provided with an annular groove 13 for a piston ring 14, and the upper end of the skirt **portion**
Per E 11 is formed with **a recess shown in the form of** an annular groove 15 for the purpose of collecting the oil that may be scraped from the cylinder during the reciprocation of the piston.

The piston is also provided with a pair of separated piston pin bosses 16 which are formed with integral supporting flanges 17 extending around the bosses and arranged intermediate their ends. These flanges extend laterally of their respective bosses in the form of webs 18 which integrally connect with the wall of the [skirt]* **guide**
Per E **portion** 11 as shown in the drawings. Since there
" E are two of these webs **or walls** 18 for each of the bosses 16 there are therefore four connections of
" E the webs 18 to the skirt **or guide portion** 11. These connections are in the four longitudinal lines as shown at 19.

The flanges 17 also extend upwardly from the
" E bosses in the form of webs **or walls** 20 leading to the head 10 and thereby connecting the bosses with the head. Thus, the bosses are connected to both the head and the skirt so that the latter is held in its proper position directly beneath the head as shown in Figs. 1 and 2.

In order that the skirt may not expand an undue amount when the piston is heated, as under operating con-

Insert E^1 ditions, [it]* **(3)** E^1 is split longitudinally as at 21. This split is slightly diagonal to prevent
Insert E^2 wearing a groove in the cylinder **(3)** E^2
[fol. 1839] The piston is further provided with
Per E conduits 22 **shown** in the form of pipes extending from the **recess or** groove 15 at the upper end of the skirt to openings 23 in the bosses. There is shown one

---

[*Matter enclosed in brackets struck out in copy.]

conduit for each boss and it will be understood that the oil collected in the groove 15 by the piston in its reciprocation is led down through the conduits 22 to the interior of the piston pin boss to thereby lubricate the bearing.

The skirt 11 is formed with openings 24 in its side registering with the openings through the bosses 16 so that the piston pin may be inserted.

Insert [E³]* F¹ **(7)** [E³]* F¹

It will be seen that in addition to providing a piston with a split [skirt,]* **guide portion** the above described construction also provides [an extremely]* **a longitudinally** rigid connection between the piston pin bosses and the [skirt]* **guide portion** of the piston, which construction may be used either with or without the split [skirt]* **guide portion** and separated head. The arrangement of the supporting flanges 17 between the ends of the piston pin bosses and the connections of those flanges with **both** the piston [skirt]* **guide portion and the head** provide a particularly strong [support for the bosses.]*

Per E " E " E " E " E Insert E⁴ **(5)** E⁴

In Figs. 5 and 6 the webs **or walls** 18 are slightly curved between the flanges 17 and the [skirt wall]* **guide portion** to thereby distribute the connection of the bosses to the [skirt]* **guide portion** more evenly around the [skirt]* **piston.** Otherwise the showing is substantially the same as in the other figures.

Per E " E " E " E Insert E⁵ **(4)** E⁵

It will be understood further that my invention is not limited to the details of construction shown and other forms may be used without departing from the spirit or scope of the invention.

(X)

Having thus described my invention, what I claim and desire to secure by Letters Patent is:—

Per A 1. A piston comprising a head, a skirt separated at its periphery **throughout its circum-** [fol. 1840] **ference** from the head, and pin bosses

[*Matter enclosed in brackets struck out in copy.]

	connected to the head and to the skirt, said skirt
Per A	being split longitudinally **from its upper edge to its lower edge and** at one side between its con-
Per E	nections to said bosses.
	2. A piston comprising a head, a skirt sep-
per A	arated at its periphery **throughout its circumference** from the head, and pin bosses connected to the head and to the skirt, said skirt being
" A	split diagonally **from its upper edge to its lower edge** between its connections to said bosses.

	1E. [3.]* A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses connected to the head and to the
Per E	upper and lower parts of the skirt, said skirt being split longitudinally at one side between its connections to said bosses.
	2E. [4.]* A piston comprising a head, a skirt separated at its periphery from the head, and
Per A	pin bosses **integrally** connected to the head and
Insert A^1	to the upper and lower part of the skirt, **(4)** A^1
	3E. [5.]* A piston comprising a head, a skirt separated at its periphery from the head, and
Per A	pin bosses **integrally** connected to the head and
Insert A^2	to the skirt in four longitudinal lines, **(4)** A^2
	4E. [6.]* A piston comprising a head, a skirt separated at its periphery from the head, and
Per A	pin bosses connected to the head, and **also connected** to the skirt **both** above and below the
Insert H^2	**bosses, (2)** H^3
per H	**5E.** [7. A]* **An integrally cast** piston comprising a head, a skirt separated at its periphery
" A	from the head, and pin bosses **integrally** connected to the head and to the skirt at both sides
Insert A^3	and in the zone of said bosses, **(2)** [H]* A^3

(over)

1092870	8. A piston comprising a head, a skirt, pis-
Per A	ton pin bosses, and connections from the bosses to the head and skirt, substantially as described.

[*Matter enclosed in brackets struck out in copy.]

Per H

6E. [8a. 9. A]* **An integrally cast** piston comprising a head, a skirt, separated piston pin bosses within the skirt, and an integral flange on each of said bosses intermediate its ends, said flange extending from both sides of the boss to the piston skirt and integrally united therewith

Insert H⁴

in the zone of the boss, **(2) H⁴.**

Per H

7E. [9a. 10.]* A piston comprising a head, a skirt, separated piston pin bosses **integral with the head and disposed** within the skirt, and ingral [means]* **transversely flexible webs** extending from the intermediate part of each of said bosses to the skirt wall in the zone of the boss for supporting the bosses from the adjacent part of the skirt.

Stabel

10a. [11.]* A piston comprising a head and skirt, said skirt having an annular groove, pin bosses within the piston, and means for con-

Per A

veying oil from said **exterior** groove to said

Per B

bosses.

" A

11a. [12.]* A piston comprising a head and skirt, said skirt having an annular **exterior**

" A

groove, pin bosses within the piston[,]* **spaced from the wall of the skirt** and [a conduit]* **pipes** leading from said groove to the interior of said bosses.

" A

8E. [10B. 12a. 13.]* A piston comprising a head, a skirt having its periphery separated from the head, pin bosses in the piston **spaced from the wall of the skirt** and conduits leading from the top of said skirt to the interior of said bosses.

Insert A⁴

9E. [11B. 13a. 14.]* A piston comprising a head, a skirt having its periphery separated from the head, pin bosses in the piston **(2) A⁴**

Per A

means **integrally** connecting the bosses with the head and skirt, and [a conduit]* **pipes** leading from the upper part of the skirt to the bosses.

[*Matter enclosed in brackets struck out in copy.]

10E. [12B. 14ε. 15.]* A piston comprising a head, a skirt, separated piston pin bosses within the skirt, and an intermediate flange on each of said bosses intermediate its ends, said flange extending laterally from both sides of the boss [fols. 1842-1874] to the piston skirt in a curve and integrally united with the skirt in the zone of the boss.

Insert C[1] **(X)**

6. 204661—6

12432

In testimony whereof I affix my signature.

EDWARD J. GULICK.

OATH

COUNTY OF ELKHART,
STATE OF INDIANA, SS.

EDWARD J. GULICK, the above named petitioner, being sworn or affirmed, deposes and says that he is a citizen of the United States, and resident of Elkhart County, State of Indiana, that he verily believes himself to be the original, first, and sole inventor of the Improvement in HYDROCARBON MOTORS described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application, or in public use or on sale in the United States for more than two years prior to this application; that said invention has not been patented in any country foreign to the United States on an application filed by him or his legal representatives or assigns more than twelve months prior to this application; and that no application for patent on said improvement has been filed by him or his representatives or assigns in any country foreign to the United States.

EDWARD J. GULICK.

Sworn to and subscribed before me this 23rd day of November, 1917.

WARD A. BERNET,
Notary Public.

(Notarial Seal)

My commission expires May 4, 1921.

204661—7

* * * * * * *

[*Matter enclosed in brackets struck out in copy.]

[fol. 1875] Here follows proceedings in Patent Office on Gulick application, including Patent Office letters and amendments, which, by agreement of the parties, are omitted except for the following abstract from an amendment filed September 11, 1922:

"Insert the following claims:

* * * * * * *

"28. A piston comprising a head and body, internal yielding ribs supporting the head and body, and means on said ribs adapted to form engaging connection with operable parts for said piston.

* * * * * * *

"Claims 26 and 27 are identical with Claims 5 and 10, respectively, of the patent to Long, No. 1,395,441.

"Claim 28 is identical with Count 1 of the Issue in Inter-

ference No. 43,351, Hartog vs. Pomeroy, which has recently been brought to applicant's attention.

"Applicant seems clearly entitled to make Claims 26, 27 and 28 and believes that he is the first inventor of the subjects matter defined in said claims.

"In the drawing, the reference numeral "19" is incorrectly applied in Figs. 1 and 5. Permission is requested to [fols. 1876-1926] have these numerals changed to agree with Fig. 3 and with the specification as shown on the print filed herewith.

Respectfully submitted,
EDWARD J. GULICK,
By MILTON TIBBETTS,
His Attorney."

"Detroit, Mich.
September 8, 1922.

(Here follows 1 photolithograph, side folio 1927-2026)

No. 204661

746A

147
179 B

MAKE THESE LINES SOLID
REMOVE CROSS HATCHING

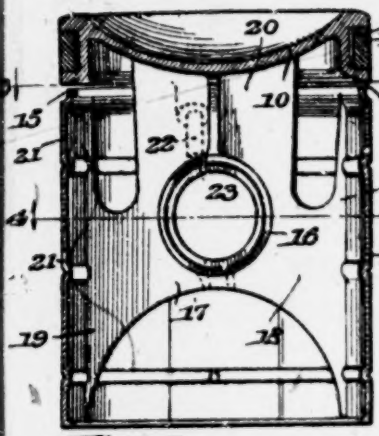


Fig. 1.

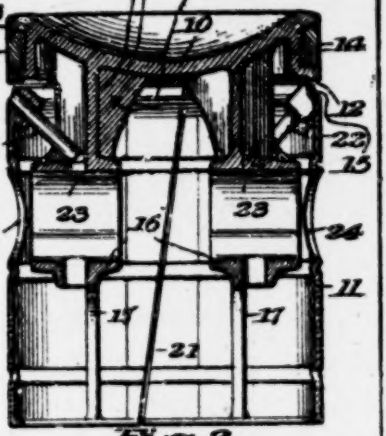


Fig. 2.

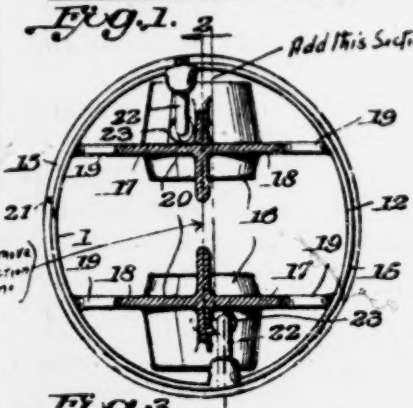


Fig. 3.

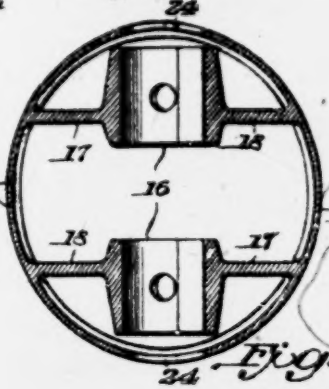
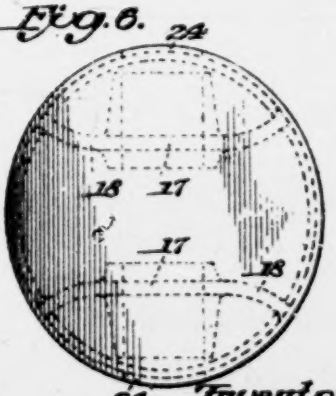


Fig. 4.

Fig. 6.



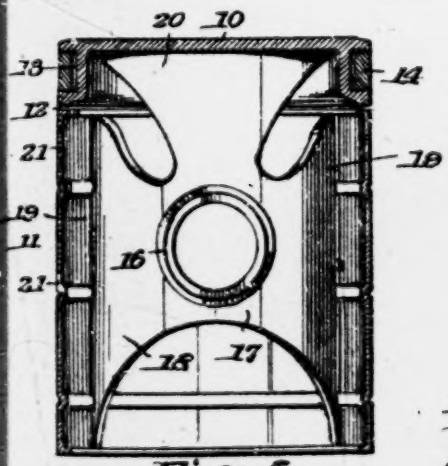


Fig. 5.

Inventor:
By Edward J. Gulick,
Milton Tibbetts, Atty.

204661 103

Tightly Bound

1927-2026

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[fol. 2027] **DEFENDANTS' EXHIBIT 4-L$_2$.**

File Wrapper and Contents of Jardine Patent in Suit.

(Filed January 27, 1934.)

390

DEPARTMENT OF COMMERCE

UNITED STATES PATENT OFFICE

To all persons to whom these presents shall come, Greeting:

THIS IS TO CERTIFY that the annexed is a true copy from the records of this office of the File Wrapper and Contents, in the matter of the Letters Patent of Frank Jardine, Assignor, by Mesne Assignments, to The Cleveland Trust Company, as Trustee, Number 1,763,523, Granted June 10, 1930, for Improvement in Pistons.

IN TESTIMONY WHEREOF I have hereunto set my hand and caused the seal of the Patent Office to be affixed, at the City of Washington, this fourteenth day of January, in the year of our Lord one thousand nine hundred and thirty-three and of the Independence of the United States of America the one hundred and fifty-seventh.

THOMAS E. ROBERTSON,
Commissioner of Patents.

(Seal)

ATTEST:
D. E. WILSON,
Chief of Division.

1920

RENEWAL

Number (Series of 1915), 1763523

[364997]* 450898 (Ex'r's Book) 162-44-D

Div. 12 Patent No. 1763523
Jun 10 1930

Name Frank Jardine, Assor. by mesne assigts. to [Aluminum Manufactures, Company of America, Incorporated,

[*Matter enclosed in brackets struck out in copy.]

of Cleveland, Ohio, Pittsburgh, Penna., a corp. of Dela-
[fol. 2028] ware, Pennsylvania.] * The Cleveland Trust Company; of Cleveland, Ohio, a corp. of Ohio, as Trustee. of Cleveland,

County of
State of Ohio
Invention Pistons.

PARTS OF APPLICATION FILED

	ORIGINAL		RENEWED	
Petition	Mar. 11, 1920			Mar. 9, 1921
Affidavit	" ", 1920			, 192
Specification	" ", 1920			, 192
Drawing 2 shts.	" ", 1920			, 192
Photo Copy	May 18, 1923			, 192
First Fee Cash $15.	Mar. 11, 1920	$15,		Mar. 8, 1921
" " Cert.	, 192			, 192
Appl. filed complete	Mar. 11, 1920			Mar. 9, 1921

Examined and Passed for Issue May 9, 1930
Sept. 8, 1920
P. P. Pierce Exr. Div. 12 P. P. Pierce Exr. Div. 12
Notice of Allowance Sept 8-1920 May 9, 1930
By Commissioner. By Commissioner.
Final Fee Cash , 192 $20 May 15, 19[2] *30
" " Cert. , 192 , 192
Patented Jun 10 1930

Attorney [Ray Stewart Gehr] *
[Euclid Bldg., Cleveland Ohio] *

[Associate] * Attorney [L. D. Watts, 307 Bangor Bldg.,] *
[451 Lennox Building, East 9th & Euclid Ave.,] *

(No. of Claims Allowed [7]* 12) Print Claim[s]* [5]* 1 in O. G.

(Cl 74-108)

[*Matter enclosed in brackets struck out in copy.]

Title as Allowed **Pistons**

Substitute Attys. Richey, [Slough]* **& Watts,** [1213 Ulmer Bldg.,]*

1983 Union Trust Bldg Cleveland, Ohio

Division of App., No. ....., filed ....., 191..

[fol. 2029]

(**$15** Rec'd Mar 11 1920 C. C. U. S. Pat. Office)

Ch

Mar 15 1920

U. S. Patent Office
Cleveland, Ohio

364997

RAY STEWART GEHR

COUNSELLOR AT LAW

Washington
Ouray Building

Patents and
Patent Causes

Cleveland
Garfield Building

March 9, 1920.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

I enclose herewith for filing petition, specification, oath and drawings, also check for $15.00 constituting the application of Frank Jardine for patent on Pistons.

Respectfully yours,

RAY S. GEHR.

RSG FR
Enclosures

364997—1

[*Matter enclosed in brackets struck out in copy.]

I 884

364997

(Mail Room Mar 11 1920 U. S. Patent Office)

Insert Division 12, **Paper No.** 1

Mar 15 1920

U. S. Patent Office

PETITION.

To THE COMMISSIONER OF PATENTS:

Your petitioner, FRANK JARDINE, a citizen of the United States and a resident of Cleveland, in the County of Cuyahoga and State of Ohio, whose post-office address is care of The Aluminum Castings Company, Cleveland, Ohio, prays that Letters Patent may be granted to him for the improvement in Pistons, set forth in the annexed specification; and he hereby appoints Ray Stewart Gehr, of 1900 Euclid Building, Cleveland, Ohio, his attorney with full power of substitution and revocation, to prosecute this ap- [fol. 2030] plication, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent Office connected therewith.

Signed at Cleveland, County of Cuyahoga, State of Ohio, this 9th day of March 1920.

FRANK JARDINE.

SPECIFICATION.

To ALL WHOM IT MAY CONCERN:

Be it known, that I, Frank Jardine, a citizen of the United States, residing at Cleveland, in the County of Cuyahoga, and State of Ohio, have invented certain new and useful improvements in pistons, of which the following is a specification, reference being had therein to the accompanying drawings.

364997—2

(Hir.) I 885

My invention relates to pistons for internal combustion engines and especially to pistons formed of light weight metals or alloys.

The invention has for its chief object the construction of

a light alloy piston which, with relatively small initial clearance, will operate satisfactorily at all temperatures in an engine cylinder.

Another object of the invention is to produce a piston of the character noted that will lend itself to economic methods of manufacture.

Because of the high co-efficient of expansion of suitable light alloys such as aluminum alloys, as compared with iron, it is often difficult to fit an internal combustion engine satisfactorily operable with iron pistons, with light alloy pistons so that such pistons will not be noisy and will not pump oil when cold, or will not stick or score the cylinder wall when heated. I have found that these difficulties can be overcome by constructing a piston with its skirt or guide portion supported and slotted or divided in a manner to permit deformation and deflection of parts thereof without interfering with the performance of the essential functions of the respective parts.

To facilitate an understanding of the invention two forms or embodiments thereof are described hereinafter and are illustrated in the accompanying drawings in which

[fol. 2031] Fig. 1 is a view partly in side elevation and partly in section of a ["slipper" type]* piston constructed in accordance with my invention.

per B

Fig. 2 is a side elevation of the same piston viewed at right angles to Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 1.

Fig. 4 is a section on the line 4—4 of Fig. 1.

Fig. 5 is a section on the line 5—5 of Fig. 1.

Fig. 6 is a view partly in side elevation and partly in section of a ["slipper" type]* piston of modified form.

per B

Fig. 7 is a side elevation of the same viewed at right angles to Fig. 6 and with parts broken away and shown in section.

Fig. 8 is a section on line 8—8 of Fig. 6.

Fig. 9 is a section on line 9—9 of Fig. 6.

[Matter enclosed in brackets, struck out in copy.]

Referring first to Figs 1 to 5, the piston shown
per B [is of the so called slipper type and]* comprises a
" B head portion 1 and a guide **or skirt** portion designated in its entirety by 2. The head portion consists of a head disc 3 and a peripheral flange 4 in which are grooves 4a for the ordinary piston rings 5. On the lower face of the head disc 3 are formed two depending webs 6 integral with the disc. These webs carry bosses 7 which are adapted to receive the ordinary wrist pin. Ribs 8 may be provided along the webs 6 between the head disc and the bosses for strengthening the webs 6 and supporting the inner ends of the bosses. Additional ribs 9 may be formed on the outer sides of webs 6 as shown to strengthen them and to support the outer ends of the bosses.

The guide portion 2 comprises two pairs of
per B [slipper]* **guide** segments 10 and 10a curved to conform to the engine cylinder, one pair being located on either side of the bosses. The segments are integral with the webs 6 and are supported and connected to the head portion 1 by means of these webs. The segments at their upper ends are separated from the flange 4 of head portion 1 by slots 11 and are further isolated from the head by slots 11a formed in webs 6. The segments of each pair are separated from one another by a longitudinally extending slot 12, said slot preferably being inclined or spirally arranged as shown. In the construction shown

per B [fol. 2032] the guide [slipper]* **portion** formed by

segments 10a is designed to take the diagonal thrust of the piston rod during the compression stroke of the engine and as said thrust is less than the corresponding
44 . thrust during the explosion stroke, said [slip-
per B per]* **portion 10a** is made narrower circumferentially
" B than the other [slipper]* **portion 10** so as to save weight.

The flange 4 of the head portion 1 has a smaller outer diameter than the guide portion 2, the diameter of the latter being only slightly smaller than the internal diameter of the cylinder in which it is to function.

[*Matter enclosed in brackets struck out in copy.]

In the operation of an internal combustion engine the piston usually is heated to a higher temperature than the cylinder wall and expands radially to a greater amount than the cylinder. This expansion reduces the clearance between the piston skirt or guide part and the cylinder wall and in the case of pistons not constructed according to my invention, if the initial clearance provided is small, scoring of the cylinder walls or piston, or seizure of the piston in the cylinder may result. With my invention, however, the guide segments 10, 10a, are capable of deformation or displacement as the piston guide parts expand, the segments being forced toward one another so as to tend to close up the
per B slots 12. The webs 6 and [slipper]* **guide** segments preferably are so designed that this displacement of the segments 10, 10a, is permitted by virtue of a bend-
per B ing of the webs 6 at points remote from the [slipper]*
" B **guide** segments. To this end, as shown in Fig. [5,]* **4**
per A the thickness of the [slipper]* **guide** segments is increased toward the webs 6 and the webs 6 are de-
" B creased in thickness from the [slippers]* **guide portions** inward toward the bosses to points in line with the inner ends of the slots 11a. This gives in effect a cantilever structure weakest at its support, namely, along
per A the dotted lines 13 in Figs. [3.]* **1 and 4**. Thus the reaction force of the cylinder wall on the outer faces
" B of the [slipper]* **guide** segments as the piston ex-

pands tends to cause bending of the webs 6 along said lines 13. Due to the bending of the web sections 6 and the forcing [fol. 2033] together of each pair of segments, the guide part of the piston may undergo a considerable thermal expansion without a corresponding increase in the outer diameter thereof and thus a small initial clearance can be used without danger of scoring or seizure of the piston.

By variation of the thickness and design of the webs 6 and the location of the slots 11a therein, the force necessary to cause the guide segments 10 and 10a to approach one another along the slot 12, or in effect to maintain the outer

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[*Matter enclosed in brackets struck out in copy.]

diameter of the piston substantially constant, can be easily regulated. The webs 6 will tend to bend along a line extending vertically downward from the ends of slots 11a and if said slots are terminated closer to the guide segments 10, 10a the region of bending will be moved outward correspondingly. Likewise a thickening of the webs 6 near the bosses will tend to move the point of bending or flexing closer to the guide segments 10, 10a. An increase of the thickness of the webs 6 obviously will increase the force necessary to cause the guide segments 10, 10a to approach one another along the slot 12.

In Figs. 6 to 9 a modified form of piston is shown. The head portion 21 is formed with a head disc 22 and a depending peripheral flange 23 in which may be formed grooves 24 for the ordinary piston rings. Depending webs 25 are formed at diametrically opposite parts of the lower edge of the peripheral flange 23. These webs carry bosses 26 for the customary wrist pin, the inner ends of the bosses being supported by ribs 27 which join the webs 25 and extend from the inner ends of the bosses 26 to the lower side of the head disc 22, while the outer ends of said bosses are supported by ribs 27a.

On either side of the bosses 26 are formed pairs of guide segments 28 and 28a similar to those shown in

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I 889

Figs. 1 to 5. These segments are united with webs 25 as shown and are separated from the flange 23 by slots 29 and further isolated from the head by slots 29a in the walls 25. The guide segments of each pair are separated from one another by longitudinally extending slots 30.

It will be seen that this last form of construction is based upon the same principles as the first form and further detailed description is therefore unnecessary. The main difference between the last form of construction and that first described resides in the webs 25 which support the wrist [fol. 2034] pin bosses and the guide [slippers,]* portions said walls being joined to the head structure at the lower edge of the ring flange 23 rather than springing from the head disc as in the first form of construction.

per B 41

From the foregoing description the operation of pistons

[*Matter enclosed in brackets struck out in copy.]

embodying my improvements will readily be understood. It will be seen that an aluminum alloy piston embodying my invention can be fitted to the engine cylinder with a very small clearance and that compensation for the relatively large thermal expansion of the guide section of the piston is provided by the displacement of the guide segments which results from the reaction force of the cylinder wall on the outer faces of the guides. As above indicated the reaction force necessary to displace the guide parts and effect such compensation can readily be controlled by properly forming and proportioning the guide parts. In this connection it will be obvious to the designer that account must be taken of such factors as compression pressures, piston diameter and piston stroke as determining the lateral thrust to which the guide parts will be subjected. It is obvious that the compensating displacement of the guide parts should require a thrust great enough to insure adequate mechanical strength of the piston and small enough to obviate scoring of the piston and cylinder or seizure of the

364997—7
I 890

piston.

While I have shown my invention applied to the slipper type of piston as distinguished from the skirt type it is to be understood that the invention is essentially applicable to other forms of construction, the scope of the invention being indicated by the appended claims.

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I 891

What I claim is—**(B′ Cls. 1-2)**

I. In a piston for an internal combustion engine, the combination of a piston head comprising a disc having an integral peripheral flange formed with ring grooves, piston rings in said grooves, two pairs of curved members oppositely disposed with relation to the axis of the piston and together adapted to function as a cylinder-engaging guide, each pair of curved members being separated from the head flange [fol. 2035] and from each other by continuous air gaps, two webs which are integral with and spring from the head disc each being connected to and integral with one of the guide members of each of said pairs thereof and constituting the only connection between the face of the piston head disc and the guide members, and

Per C

wrist pin bosses formed in these webs in which they are so positioned as to lie between the pairs of guide members as set forth.

2. In a piston for an internal combustion engine, the combination of a piston head comprising a disc having an integral peripheral flange formed with ring grooves, two pairs of curved members oppositely disposed with relation to the axis of the piston and together adapted to function as a cylinder-engaging guide, each pair of curved members being separated from the head flange and from each other by continuous air gaps, two webs which are integral with the piston head, each being connected to and integral with one of the guide members of each of said pairs thereof and constituting the only connection between the piston head and the guide members, and wrist pin bosses formed in these webs in which they are so positioned as to lie between the pairs of guide members as set forth.

3. In a piston for an internal combustion engine, the combination of a piston head comprising a disc having an integral peripheral flange formed with ring grooves, two pairs of curved guide members oppositely disposed with relation to the axis of the piston and to-

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I 892

gether adapted to function as a cylinder-engaging guide, the curved members of each pair thereof being separated from the head flange and from each other by continuous air gaps, two webs integral with the piston head and connected to the adjacent guide members, and wrist pin bosses formed in these webs in which they are so positioned as to lie between the pairs of guide members as set forth.

[4.]* **1c** In a piston for an internal combustion engine, the combination of a piston head having a depending ring flange, two pairs of curved guide members oppositely disposed with relation to the axis of the piston, the curved members of each pair thereof being separated **Per A** from the [head]* **ring** flange and from each other [fol. 2036] by continuous air gaps, and webs carry- **Per G** ing wrist pin bosses, the said curved members, piston head and webs being united in an integral unitary structure.

[*Matter enclosed in brackets struck out in copy.]

5. In a piston for an internal combustion engine, the combination of a piston head comprising a head disc and a depending peripheral flange formed with ring
Per C grooves, and a guide formed integrally with the head and comprising two pairs of cylinder-engaging curved members oppositely disposed with relation to the axis of the piston and two webs each connected to the head and to one of the guide members of each of said pairs thereof, each pair of curved members being separated from the head flange and from each other by continuous air gaps, and wrist pin bosses formed in the webs in which they are so positioned as to lie between the pairs of guide members as set forth, the said guide structure being adapted to permit the curved members of each pair to approach each other under the reaction forces of the cylinder when the piston is heated.

[6.]* **2c** In a piston for an internal combus-
Per H tion engine, the combination of a piston head comprising a head disc and a depending peripheral flange formed with ring grooves, curved guide mem-

364997—10
I 893

bers separated from the piston head by air gaps, webs in which wrist pin bosses are formed, the curved members, piston head and webs being integrally united and formed in such a manner that the said members on either side of the said bosses may approach each other as the piston expands to maintain substantially constant the diameter of the said curved members when taken together.

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7. In a piston for an internal combustion engine, the combination with a piston head comprising a disc and a depending peripheral flange formed with ring
Per C grooves, of a guide structure operably connected to the head and comprising two pairs of cylinder-engaging curved parts and two webs each connected to one curved member of each pair and formed with a wrist pin aperture, each pair of curved guide parts being separated from the head flange and from each other by continuous

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[*Matter enclosed in brackets struck out in copy.]

air gaps and the guide structure being adapted to permit [fol. 2037] the curved guide members of each pair to approach each other under the reaction forces of the cylinder when the piston is heated.

Insert A[1]

364997—11
I 894

In Testimony Whereof, I hereunto affix my signature.

Frank Jardine.

OATH

County of Cuyahoga,
State of Ohio, ss.

Frank Jardine, the above named petitioner, being duly sworn, deposes and says he is a citizen of the United States and a resident of Cleveland, in the County of Cuyahoga and State of Ohio; that he verily believes himself to be the original, first and sole inventor of the improvement in Pistons, described and claimed in the annexed specification; that he does not know and does not believe that the same was ever known or used before his invention or discovery thereof, or patented or described in any printed publication in any country before his invention or discovery thereof, or more than two years prior to this application, or in public use or on sale in the United States for more than two years prior to this application; that said invention has not been patented in any country foreign to the United States on an application filed by him or his legal representatives or assigns more than twelve months prior to this application; and that no application for patent on said improvement has been filed by him or his legal representatives or assigns in any country foreign to the United States.

Frank Jardine.

Sworn to and subscribed before me this 9th day of March, 1920.

Geo. B. Pitts,
Notary Public.

(Seal)

364997—12

[fol. 2038] (Mail Room Jun 19 1920 U. S. Patent Office)
(Docket Clerk Jun 19 1920)

#2
Doc

Frank Jardine,
Pistons,
Ser. No. 364,997,
Filed March 11, 1920.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

All Powers of Attorney previously granted in this application are hereby revoked.

I hereby appoint B. D. Watts, of [1900 Euclid Avenue,]* **307 Bangor Bldg.** Cleveland, Ohio, my attorney with full power of substitution and revocation, to prosecute this application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent Office connected therewith.

Signed at Cleveland, in the County of Cuyahoga and State of Ohio, this 14th day of June, 1920.

FRANK JARDINE.

(U. S. I. R. Documentary Stamp, 25 Cents)
(Accepted Jun 22 1920 R. F. Whitehead
First Assistant Commissioner.)

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146
EEG

#3

Address only
The Commissioner of Patents
Washington, D. C.

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE

Washington, D. C., June 23, 1920.

You are hereby informed that YOUR POWER OF ATTORNEY [REVOKED]*
HAS BEEN ACCEPTED in the matter of the application of

[*Matter enclosed in brackets struck out in copy.]

[fol. 2039] Frank Jardine for Letters Patent for an Improvement in Pistons, No. 364,997, Filed March 11, 1920.

Very respectfully,

JAMES T. NEWTON,
Commissioner.

B. D. WATTS,
307 Bangor Bldg.,
Cleveland, Ohio.

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2—369

145
EEG

Address only
The Commissioner of Patents
Washington, D. C.

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington, D. C., June 23, 1920.

You are hereby informed that YOUR POWER OF ATTORNEY REVOKED / HAS BEEN [ACCEPTED]* } in the matter of the application of Frank Jardine for Letters Patent for an IMPROVEMENT IN Pistons, No. 364,997, Filed March 11, 1920.

Very respectfully,

JAMES T. NEWTON,
Commissioner.

RAY STEWART GEHR,
Euclid Bldg.,
Cleveland, Ohio.

364997—15

[*Matter enclosed in brackets struck out in copy.]

[fol. 2040] (Mail Room Jul 12 1920 U. S. Patent Office)

Division 12, **Paper No. 4**
Jul 13 1920
U. S. Patent Office

BLYTHE D. WATTS
Solicitor of Patents
[1900 Euclid Ave.]*
Cleveland, Ohio
451 Lennox Bldg.,

July 9th, 1920.

In Re Application of
Frank Jardine,
Pistons,
Serial No. 364,997,
Filed March 11, 1920

Hon. Commissioner of Patents,
Washington,
D. C.

Dear Sir:—

In the above identified application, kindly note that my address has been changed from,

Room 307 Bangor Bldg., 942 Prospect Ave.,
Cleveland, Ohio

to

Room 451 Lennox Bldg., East 9th & Euclid Ave.,
Cleveland, Ohio

Yours very truly,

BDW
kmc

B. D. WATTS,

364997—16

[*Matter enclosed in brackets struck out in copy.]

[fol. 2041] (Patent Office Sep 8-1920 Mailed)

2—181

Div. 12
Ch:I

Serial No. 364,997

Address only
The Commissioner of Patents,
Washington, D. C.

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington, Sept. 8, 1920.

Frank Jardine,

Sir: Your Application for a patent for an Improvement in Pistons filed Mar. 1, 1920, has been examined and Allowed.

The final fee, Twenty Dollars, must be paid not later than Six Months from the date of this present notice of allowance. If the final fee be not paid within that period, the patent on this application will be withheld, unless renewed with an additional fee of $15, under the provisions of Section 4897, Revised Statutes.

The office delivers patents upon the day of their date, and on which their term begins to run. The printing, photolithographing, and engrossing of the several patent parts, preparatory to final signing and sealing, will require about four weeks, and such work will not be undertaken until after payment of the necessary fee.

When you send the final fee you will also send, Distinctly and Plainly Written, the name of the Inventor, Title of Invention, and Serial Number as Above Given, Date of Allowance (which is the date of this circular), Date of Filing, and, if assigned, the Names of the Assignees.

If you desire to have the patent issue to Assignees, an assignment containing a Request to that effect, together with the Fee for recording the same, must be filed in this office on or before the date of payment of final fee.

After issue of the patent uncertified copies of the drawings and specifications may be purchased at the price of

[Five]* **Ten** Cents Each. The money should accompany the order. Postage stamps will not be received.
[fol. 2042] Final fees will Not be received from other than the applicant, his assignee or attorney, or a party in interest as shown by the records of the Patent Office.

Respectfully,

[JAMES T. NEWTON,]*
R. F. Whitehead.
Commissioner of Patents.

B. D. WATTS,
451 Lennox Bldg., East 9th & Euclid Ave.,
Cleveland, Ohio.

☞ In Remitting the Final Fee Give the Serial Number at the Head of This Notice.
☞ Uncertified Checks Will Not Be Accepted.

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(**$15** Rec'd Mar 8 1921 C. C. U. S. Pat. Office **26**)
(Application Div. Mar 9 1921 U. S. Patent Office)

Renewal

Division 12, **Paper No. 5**
Mar 16 1921
U. S. Patent Office.

RENEWAL PETITION

To the Commissioner of Patents:

Your petitioner, Frank Jardine, a citizen of the United States, and a resident of Cleveland, in the County of Cuyahoga, and State of Ohio, whose post-office address is Care of the Aluminum Castings Company, Cleveland, Ohio, represents that on the 11th day of March 1920, he filed an application for Letters Patent for an improvement in Pistons, Serial No. 364,997 which application was allowed September 8th 1920, but that he failed to make payment of the final fee within the time allowed by law. He now makes

[*Matter enclosed in brackets struck out in copy.]

renewed application for Letters Patent for said invention, and prays that the original specification, oath and drawings, may be used as a part of this application.

[fol. 2043] Signed at Cleveland, in the County of Cuyahoga and State of Ohio, this 7 day of March 1921.

FRANK JARDINE,
By B. D. WATTS,
His Attorney.

Pet. redated Mar. 9, 1921 as case had not forfeited on date petition was rec'd Mar. 8/21.

Appl'n Div. P
364997—18

(Mail Room Mar 8 1921 U. S. Patent Office)

Division 12, **Paper No. 6**
Mar 16 1921
U. S. Patent Office.
A

In Re Application of
Frank Jardine,
PISTONS
Serial No. 364,997
Filed March 11th 1920
Allowed September 8th 1920
Renewed

Hon. Commissioner of Patents,
Washington,
D. C.
A

Sir:

Applicant amends the above identified application as follows:

Page 3, line 25 cancel "5" and insert, —*4*—.

Page 3, next to last line, change "Fig. 3", to —*Figs. 1 and 4*—.

Claim 4, line 5 cancel "head" and insert —*ring*—.

Enter the following claims as claims, 8, 9, 10 and 11.

8. —In a piston for an internal combustion
Sub B′ engine, the combination of a substantially cylin-
A′ drical piston head having grooves therein, piston rings in said grooves, a skirt for said piston head connected to the same, piston pin bosses in said piston, the portions of the skirt adjacent the outer ends of the bosses, being relieved all along the length of the skirt, said piston [fol. 2044] being provided with horizontal slots adjacent the junction of the head and the skirt and

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with a vertical, or substantially vertical, slot extending thruout, or substantially thruout, the length of the skirt.

9. —In a piston for an internal combustion engine, the combination of a substantially cylindrical piston head having grooves therein, piston rings in said grooves, a skirt for said piston head connected to the same, piston pin bosses in said piston, the portions of the skirt adja-
6 cent the outer ends of the bosses being relieve[s]*d all along the length of the skirt, said piston being provided with a vertical, or substantially vertical,
8 slot e[c]*xtending, from near the junction of the skirt with the head, thruout, or substantially thruout, the length of the skirt to or near the lower end of the skirt.

10. —In a piston for an internal combustion engine, the combination of a substantially cylindrical piston head having grooves therein, piston rings in said grooves, a skirt for said piston head connected to the same, piston pin bosses in said piston, the portions of the skirt adjacent the outer ends of the bosses being relieved all along the length of the skirt, said piston head being provided with circumferential slots adjacent the junction of the head and the skirt, and with a vertical, or substantially vertical, slot, substantially midway between the ends of the piston pin bosses joining one of the horizontal slots at one end and extending thruout, or substantially thruout, the length of the skirt to or near the lower end of the skirt.

11. —In a piston for an internal combustion en-
2 gine, the co[n]*mbination of a substantially cylindrical piston head having grooves therein, piston rings in said grooves, a skirt for said piston head connected

[* Matter enclosed in brackets, struck out in copy.]

to the same, piston pin bosses in said piston, portions of the skirt adjacent the outer ends of the bosses being relieve[s]*d, said piston being provided with cir-

364997—20

cumferential slots adjacent the junction of the head and the skirt, and with a vertical, or substantially vertical, slot substantially midway between the ends of the piston pin bosses, adjoining one of the horizontal slots at one end and extending thruout, or substantially thruout, the length of the skirt to or near the lower end of the skirt.

[fol. 2045] It is believed that the new claims herewith presented are clearly allowable and early and favorable action is solicited.

Respectfully submitted,

FRANK JARDINE,

By B. D. WATTS,

His Attorney.

—3— 364997—21

SUPPLEMENTAL OATH

STATE OF OHIO,
CUYAHOGA COUNTY, SS.

Frank Jardine, whose application for Letters Patent for an improvement in PISTONS, serial No. 364,997, was filed in the United States Patent Office on or about March 11th 1920, being duly sworn deposes and says that the subject matter of the foregoing amendment attached hereto and containing new claims 8, 9, 10, 11, [12]* was part of his invention, was invented before he filed his original application above identified for such invention, was not known or used before his invention, was not patented or described in a printed publication in any country more than two years before his application, was not patented in a foreign country on an application filed by himself or his legal representatives or assigns more than twelve months before his application, was not in publi[s]*c use or on sale

[*Matter enclosed in brackets struck out in copy.]

in this country for more than two years before the date of his application, and has not been abandoned.

FRANK JARDINE.

Sworn to before me and signed in my presence this 25th day of Feb. 1921.

MERLE B. PRICE,
Notary Public.

364997—22

[fol. 2046] (Patent Office Apr 9 1921 Mailed)
2—260

Div. 12 Room 322 **Paper No. 7**

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.
Ch-D

All communications respecting this application should give the serial number, date of filing, title of invention, and name of the applicant.

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE

Washington Apr. 9, 1921.

B. D. Watts,
451 Lennox Bldg.,
East 9th St. & Euclid Ave.,
Cleveland, Ohio.

Please find below a communication from the Examiner in charge of the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898 PISTONS.

THOMAS E. ROBERTSON,
Commissioner of Patents.

Responsive to amendment of Mar. 8, 1921.

Claim 9, line 6 "relieves" should be *relieved.* Line 8 "ectending" should be *extending.*

Claim 11, line 2 "combination" is misspelled. Line 6 "relieves" should be *relieved.*

Claims 8 to 11 inclusive are rejected as defining structure unwarranted by the specification and drawing. The slot 12 is described in the specification and shown on the drawing as being spiral or diagonal. It would therefore be inconsistent to claim a "vertical" slot. Applicant is also unwarranted in claiming horizontal slots extending *"substantially thruout"* the length of the skirt when he only shows a slot extending *thruout.*

The expressions "throughout, or substantially throughout," "vertical or substantially vertical" and "the length [fol. 2047] of the skirt to or near the lower end—" are objectionable as being alternative.

The remaining claims stand allowed.

P. P. PIERCE,
Examiner.

V.I.C.

364997—23

I 895

(Mail Room Jan 29 1922 U. S. Patent Office)
Division 12, **Paper No. 8**
Jan 24 1922
U. S. Patent Office
12

B Sup. Oath

In Re Application of
Frank Jardine,
PISTONS
Serial No. 364,997 **Renewal No. 450,898**
Filed March 11th, 1920.
Allowed September 8th, 1920.
Renewed.

Cleveland, Ohio.
January 20, 1922.

Hon. Commissioner of Patents,
Washington,
D. C.

Sir:—

B

Applicant amends the above identified application as follows:—

Page 1, line six from the bottom, cancel "slipper type".

Page 2, line 3, cancel "slipper type".

Page 2, lines 9 and 10, cancel "is of the so-called slipper type and". Page 2, line 11, between "guide" and "portion" insert *or skirt*.

Change "slipper" to *guide* in the following places:—

Page 2, line 22; page 3, line 21; page 3, line 24; page 3, line 25; page 3, last line.

Page 2, last line, change "slipper" to *portion*.

Page 3, line 4, change "slipper" to *portion 10a*. Page 3, line 5, change "slipper" to *portion 10*. Page 3, line 5, from the bottom, change "slippers" to *guide portions*.

[fol. 2048] Page 5, line 11, change "slippers" to *portions*.

Cancel claims 8 to 11 inclusive and substitute the following:—

[3c. 8.]* **1.** In a piston for an internal combustion
B[1] engine, the combination of a head having ring grooves therein, a plurality of webs integral with said head and having diametrically opposite piston pin bosses therein, a skirt integral with said webs relieved adjacent said webs and separated from the head by cir-

cumferential slots and provided with a longitudinal slot connecting the lower end of the piston with one of the circumferential slots. **(over)**

[9.]* **4c** In a piston for an internal combustion engine
the combination of a head having ring grooves therein, a
plurality of cordal webs integral with said head
Per H and having diametrically opposite piston pin bosses
therein, a skirt integral with said webs, relieved
adjacent said webs and separated from the head by cir-
cumferential slots and provided with a longi-
Per G tudinal slot [connecting]* **lying on a line extending from** the lower end of the piston [with]* **to** one of
the circumferential slots.

[10.] **5c** In a piston for an internal combustion engine,
the combination of a head having ring grooves therein,
a plurality of webs integral with the head and extending
downwardly therefrom, diametrically opposite piston pin

[*Matter enclosed in brackets struck out in copy.]

bosses in said webs, a skirt for said piston, relieved
Per G. adjacent said webs **to expose said bosses,** with circumferential slots between said head and skirt,
" G and having a longitudinal slot **lying on a line extending from** connecting the lower end of the skirt with one of the slots.

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11. In a piston for an internal combustion engine the combination of a head having ring grooves therein, a plurality of webs connected to the piston head and ex-
Per C tending downward therefrom, diametrically oppositely disposed wrist pin bosses, one in each of said webs, a skirt for said piston connected to the side edges of the webs and relieved adjacent the webs to expose the webs and the bosses, said piston provided with circumferen-
[fol. 2049] tial slots between the skirt and head and with a longitudinal slot extending from a circumferential slot to the open end of the skirt.

12. In a piston for an internal combustion engine, the combination of a head, a plurality of webs each connected integrally at one end with the head and projecting downwardly therefrom, and piston pin bosses in each web, a skirt for said piston connected integrally with the

364997—25
I 897

side edges of the webs and relieved adjacent the webs to expose the webs and the bosses, said piston provided with circumferential slots between the piston head and the piston skirt portion, and with a longitudinal slot extending from the open end of the skirt to one of the circumferential slots.

[6c 13.]* 2. In a piston for an internal combustion engine the combination of a head comprising a head disc and a peripheral flange having ring grooves
Per I therein, a pair of chordal webs, substantially rectangular in shape and located opposite each other in the piston, connected integrally at their upper edges to the peripheral flange of the piston, diametrically opposite wrist pin bosses, one in each of said webs, a skirt for said piston integrally connected to each of the side edges of the webs and cut away so as to expose each of the rectangular webs and the piston pin bosses from the outside of the pis-

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[*Matter enclosed in brackets struck out in copy.]

ton, said piston being provided with circumferential slots between the skirt and head and with a longitudinal slot extending from one of the circumferential slots to the open end of the piston. **(G'/Cls. 3-12)**

[14.]* **7c** In a piston for an internal combustion engine, the combination of a head provided with **having** ring grooves therein, a pair of webs integral with and dependent from said head and located opposite each other, diametrically oppositely disposed wrist pin bosses, one in each of said webs, a skirt for said piston, integrally connected to each of the side edges of the webs, said piston being provided with circumferential slots between the skirt and head and with a longitudinal slot extending from one of the circumferential slots to the open end of the piston.

Per H

[15.]* **8c** In a piston for an internal combustion engine, the combination of a head and a pair of cordal webs sub- [fol. 2050] stantially rectangular in shape, located opposite each other in the piston and connected integrally at their upper edges to the piston head, diametrically oppositely disposed wrist pin bosses, one in each of said webs, and

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I 898

a skirt for said piston integrally connected to each of the side edges of the webs, said piston being provided with circumferential slots between the skirt and head and with a longitudinal slot extending from one of the circumferential slots to the open end of the piston.

[16.]* **9c** In a piston for an internal combustion engine, the combination of a head, webs integrally connected to said head and dependent therefrom, oppositely disposed piston pin bosses mounted one in each of said webs and integral therewith, a skirt for said piston integrally connected to each of said webs and extending beyond the same, said piston provided with circumferential slots between the head and skirt and with a longitudinal slot connecting one of said circumferential slots and the open end of the skirt of the piston.

10c [17.]* In a piston for an internal combustion engine the combination of a head having ring grooves therein, a plurality of cordal webs integrally connected with the

[*Matter enclosed in brackets struck out in copy.]

piston head and extending downwardly therefrom, oppositely disposed piston pin bosses, integral with said webs and mounted therein, a skirt for said piston longer than said webs and interconnected at the side edges of the webs to each of said webs, said piston being provided with circumferential slots between the head and skirt and with a longitudinal slot connecting one of said circumferential slots with the open end of the skirt.

Insert
[D]* **G**

REMARKS.

I 899

Rather than amend the claims applicant has cancelled claims 8 to 11 inclusive and rewritten the same. Applicant does not agree that the expressions are alternative and does not abandon any of the matter originally claimed in claims 8 to 11 but intends that the new claims shall cover the piston [fol. 2051] illustrated in the drawings and all of the mechanical equivalents thereof. A supplemental oath is filed herewith.

Respectfully submitted,
B. D. Watts,
Attorney for Applicant.

Jan. 20, 1922.

(Mail Room U. S. Patent Office Jan. 1922)

SUPPLEMENTAL OATH

State of Ohio }
Cuyahoga County } ss.

Frank Jardine, whose application for Letters Patent for an improvement in Pistons, serial No. 364,997, was filed in the United States Patent Office on or about March 11th, 1920, being duly sworn deposes and says that the subject matter of the foregoing amendment attached hereto and containing new claims 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, was

[*Matter enclosed in brackets struck out in copy.]

part of his invention, was invented before he filed his original application above identified for such invention, was not known or used before his invention, was not patented or described in a printed publication in any country more than two years before his application, was not patented in a foreign country on an application filed by himself or his legal representatives or assigns more than twelve months before his application, was not in public use or on sale in this country for more than two years before the date of his application, and has not been abandoned.

FRANK JARDINE.

Sworn to before me and signed in my presence this 16th day of January, 1922.

MERLE B. PRICE,
Notary Public.

(Notarial Seal)

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[fol. 2052] (Mailed Patent Office Jan. 30 1922)
2—260

Div. 12 Room 322 **Paper No. 9**

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.
Ch-D

All communications respecting this application should give the serial number, date of filing, title of invention, and name of the applicant.

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, Jan. 30, 1922

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a communication from the EXAMINER in charge of the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS.

THOMAS E. ROBERTSON,
Commissioner of Patents.

Responsive to the amendment of Jan. 23, 1922.

Claims 1, 2 and 3 are rejected as being unpatentable over Claim 4 in view of

Ricardo, 1,294,833, Feb. 18, 1919 (74-108)

Claims 5, 6 and 7 are rejected as being substantially duplicates of each other. Applicant may select either one of these claims that he desires.

Claims 9 to 17 inclusive are rejected as being unpatentable over claim 8 in view of Ricardo, supra. Applicant's alleged invention involves merely the slitting of the curved guide members or slippers shown by Ricardo. Inasmuch as this feature appears to be the only patentable novelty over the reference, the claims in this case are unnecessarily multiplied and applicant is required to cut the number of [fol. 2053] claims down in proportion to the patentable subject matter contained in the case. See in re Duncan 276 O. G. 211.

Claims 4 and 8 appear allowable.

P. P. PIERCE,
Examiner.

V. I. C.

364997—30

(Mail Room U. S. Patent Office Feb 6 1922)

Division 12, **Paper No. 10**
Feb 7 1922
U. S. Patent Office.

IN THE UNITED STATES PATENT OFFICE

Applicant : Frank Jardine.
Invention : Pistons.
Serial No. : 450,898.
Filed : Renewal.

Div. 12, Ch. 1.
Room 322.

Cleveland, Ohio.
February 2nd, 1922.

Hon. Commissioner of Patents,
Washington, D. C.

C Sir:—

Responsive to Office Action dated January 30th, 1922. Cancel claims 1, 2, 3, 5, 7, 11, and 12, and renumber the remaining claims consecutively.

REMARKS

Applicant has materially reduced the number of claims in the case, and asks that the remaining claims be allowed. These cancellations bring the case well within the practice in this art, as indicated by the patents to Mooers, 1,402,309, Jan. 3, 1922, and Turner, 1,312,879, and 1,312,880, Aug. 12, 1919.

On reconsideration, applicant believes the Examiner will agree that the claims recite combinations of elements, and are not, as the Examiner suggests, merely the piston of the Ricardo patent with the addition of a slot. This follows from the fact that the addition of the slot changes the structure and the resistance to, and the disposal of, the forces within and without the piston when the piston is in use. [fol. 2054] Pressures operating on the piston, will operate in different directions and must be met and handled in such a way as to realize the advantages sought for.

364997—31

The Ricardo piston has not been generally adopted commercially, while the claimed pistons are in quite general and successful commercial use. Consequently, the various parts operate in a different manner from the Ricardo piston.

We have carefully considered the decisions of ex parte Duncan and in re Duncan. Duncan's case was an extraordinary one, requiring drastic handling, we are satisfied that neither the Commissioner nor Judge Van Orsvel intended to depart from the well established rule set up in the following cases:

In *Dick v. Underwood,* 246 F. R., 309, Judge Hazel said, at p. 313:—

> "Criticism is made upon the multiplication of claims; but, as they all relate to the same subject-matter and are both broad and specific, they were undoubtedly differently phrased to protect the patentee against any possible prior inventions, an expedient that does not invalidate them. *Parke & Davis & Co. v. H. K. Mulford Co.* (C. C.) 189 Fed. 95, affirmed 196 Fed. 496, 116 C. C. A. 262."

In *Parke v. Mulford,* 189 F. R., 95, Judge Hand said, at p. 102 and 103:—

> "The first of the technical objections is because of the vague character of the claims of the patent and

their fraudulent reduplication. I can see no basis whatever for this contention. As I have already said, the claims were not for the active principle, nor for the product of the process. Of course claims for a product not defined as the product of a process must contain in themselves adequate differentia, or they will not be good (*Cochrane v. Baddische Anilin Fabrik,* 111 U. S. 293, 310, 4 Sup. Ct. 455, 28 L. Ed. 433); *but the only valid objection to multiplication of claims is when it appears that the patentee is trying deceitfully to go beyond the fair scope of his invention.* I can see no evidence of that here, and the fact that I have sustained the broader claim is a complete answer to such a position. That Takamine in a number of instances should have added other claims more circumscribed in their scope was natural enough, and *what every prudent* [fol. 2055] *solicitor ought to do.* No one can in advance know how far anticipations will go or how little in the end his patent will cover. There is nothing improper, so far as I can see, in first putting your claims as broadly as in good faith you can, and then, *ex abundanti cautela,* following them successively with narrower claims designed to protect you against possible anticipations of which you are not yet aware. Indeed, the very case upon which the defendant relies (*Matheson v. Campbell,* 78 Fed. 910, 917, 24 C. C. A. 384) shows the necessity of claims as broad as one can honestly support. If

any one of the specified differentia of the claim is missing, the defendant's product does not infringe; if any anticipation includes all the differentia, the claim is bad. To pass between this Scylla and the Charybdis, I think a patentee may fairly be entitled to bend sails upon many yards." (Italicizing ours.)

Indeed, the decision of ex parte *Halverson,* 283 O. G. 182, is a warning that ex parte *Duncan* is not to change the well established practice which has been followed in the Federal cases we have cited.

In addition to the reasoning of the courts in the cited

cases, we might add that we have found no record of any patent which has been held invalid because of the multiplicity of claims, though many patents have been assailed on that ground. On the contrary, the number of patents which have failed because of too few claims is legion. The equity spirit, which should prevail in adjudicating the claims on meritorious inventions, dictates that the doubt be resolved in favor of allowing the claims, and not by restricting them, endanger the protection on the invention.

If we were to limit ourselves to claim 8 alone of the group including 8 to 17, and prior art, not now developed, was found to anticipate this claim, that feature of the invention would be defeated, and the inventor would be without protection thereon. Such prior art might not, however, as frequently happens, anticipate the narrower claims such as 9 to 17 inclusive.

It has been our observation that settled doctrines of law, like that established by the Federal authorities which we have cited, are often disturbed by some extraordinary case or some extraordinary view of some particular court, and that much harm is done by an effort to follow the extraordinary case or the extraordinary view, and that ultimately [fol. 2056] the law goes back into the established channel. It would be regrettable, if the very useful invention here under consideration, were in any way impaired

by departing from the established law as set forth in the Federal decisions which we have cited.

As a matter of precaution, we say that the cancellation of claims made in this amendment, has not been made with the purpose of abandoning the subject matter thereof, but, merely to meet the Examiner's requirement with regard to the number of claims, and because the remaining claims cover the substance of those cancelled.

An allowance is requested.

Respectfully,

B. D. WATTS.
Attorney for Applicant.

BDW: F

364997—34

(Patent Office May 6-1922 Mailed)

2—260

Div. 12 Room 322 **Paper No. 11**

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.

All communications respecting this application should give the serial number, date of filing, title of invention, and name of the applicant.

Ch-D

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington May 6, 1922

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a communication from the EXAMINER in charge of the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS.

THOMAS E. ROBERTSON,
Commissioner of Patents.

[fol. 2057] Responsive to the amendment of Feb 6, 1922.

Claim 4, 5, 7, 8, 9 and 10 are rejected as being unpatentable over claim 3 in view of Ricardo, of record. The remarks submitted by applicant on Feb. 6, 1922 and the decisions therein cited have been carefully noted but it is not thought that they are in point with the question at issue. The Examiner does not contend that a patent would be rendered invalid by reason of the fact that the claims therein have been unduly multiplied or even that they were duplicates of each other. It is thought that applicant should point out the patentable difference between the several claims. At the present time the Examiner is unable

to discover any such patentable difference between the same.

The remaining claims are allowed.

P. P. PIERCE,
Examiner.

V. I. C.

364997—35

(Application Room Jun 15 1922 U. S. Patent Office)

Division 12, **Paper No. 12**
Jun 16 1922
U. S. Patent Office

IN THE UNITED STATES PATENT OFFICE

In the application of
Frank Jardine,
For Pistons
Serial No. 450,898,
Filed March 9, 1921.

Cleveland, Ohio, [May]* **June 14** 1922.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

Applicant responds as follows to the official action dated May 6, 1922.

It is noted that claims 1, 2, 3 and 6 have been allowed, but that claims 4, 5, 7, 8, 9 and 10 are rejected as unpatentable over allowed claim 3 in view of Ricardo.

It is further noted that the examiner thinks the claims should be patentably different and that such difference between the various claims should be pointed out.

Applicant believes that it is not the rule to require that the various claims in a case should be patentably different [fol. 2058] from each other in the sense that claims in different applications are required to be distinguished. Where the claims in one application must set forth a structure patentable over structure allowable in another case, the claims in a single application need not be so clearly distinguished. If another rule is followed it would be impos-

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[*Matter enclosed in brackets struck out in copy.]

sible to obtain broad and narrow claims of the same structure in a single application, as this has been repeatedly held to be not only permissible but essential in proper soliciting of patents. (See two cases cited in applicants amendment dated February 6, 1922 in this application.)

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Although it has been held by the courts that every claim of a patent is to be considered as setting forth a complete and independent invention, this practice has not been followed to the extent which the language might lead one to expect, since it has been repeatedly held that if two or more claims appear to be alike they will, if practicable, be held to differ rather than to agree. (See Walker on patents 5th Addition page 226, paragraph 177.)

This practice was followed in each of the cases quoted from in applicant's last action where broad and narrow claims which differ in phrasing were held to be valid.

Furthermore, applicants contention that claims in an application need not differentiate patentably over each other is sustained by the case of *Wm. B. Scaife & Sons Co. v. Falls City Woolen Mills.* (Circuit Court of Appeals, 209 F. R. 210, November 4, 1913.) The pertinent part of this Circuit Court decision is as follows, the italics being ours.

> This patent is one having a series of twelve claims. It is sometimes said that in such case each claim should be considered as a separate patent. This statement, accurate enough for some purposes, is misleading, if followed too far; but we must at least say that, usually, proper construction and effect can be given to each claim only by differentiating it from the other claims. *Each claim should be capable of such differentiation else it has no right to exist*; and the difficulty often found in doing so, caused by repetition and confusion, does not effect the propriety of this rule of construction in a normal case where it can be clearly applied. *Each claim should be directed at some function, step,* [fol. 2059] *or advantage to give it individuality; it should have a characterizing thought of point by which it can be identified;* and, of the court which is to construe the claim can find this dominant thought, its task will be simplified.

Assuming the rule to be as set forth by applicant, the distinctions between the various claims will now be pointed out. Claims 4, 8 and 10 belong to the same general group, involving chordal webs differently defined in the various claims, each claim being distinguished from claim 3 by limitations to the specific kind of webs, namely, chordal webs as contrasted with other types of webs

which was described by the broader wording of claim 3. Similarly claims 5, 7 and 9 belong to a single group where each of the claims is distinguished from the others by certain limitations. For example, claim 5 sets forth a skirt relieved adjacent the webs, claim 7 sets forth a pair of webs with a skirt connected to the side edges of the webs, and claim 9 sets forth the skirt extending beyond the webs. In addition to being thus different from one another the claims are distinguished from claim 3 among other things in these particulars above mentioned.

It has been our personal experience that patents are often held invalid because of having too few claims, but that multiplicity of claims has never been the cause of a patent being held invalid. If a court should decide there are too many claims it may declare certain ones thereof invalid without invalidating the whole patent. Furthermore, if a patent is granted with a limited number of claims it may and in fact often does happen that a meritorious invention is lost to the inventor through non-infringement of anyone of the claims granted, whereas if additional claims stating the invention is slightly different terms, has been issued by the competing structure would have been technically, as it was actually, an infringement. By insisting on the claims in this case applicants attorney is inspired [in]* by the belief that both the examiner and himself are working to the common end of issuing patents covering the invention in a manner to assure to the inventor the full benefit of his invention.

The accomplishing of anything less than this injustly deprives the inventor of what was rightfully his and reflects on the workmanship of both the attorney and examiner.

[* Matter enclosed in brackets, struck out in copy.]

[fol. 2060] It is believed that the claims now in the case are allowable, and for the many reasons heretofore cited

should be granted. An early allowance is earnestly requested.

Respectfully submitted,
B. D. WATTS.
364997—39

(Mail Room Jul 21 1922 U. S. Patent Office)

Division 12, **Paper No. 13**
Jul 22 1922
U. S. Patent Office

IN THE UNITED STATES PATENT OFFICE

In the application of
Frank Jardine,
For PISTONS,
Serial No. 450,898
Filed March 9, 1921.

Cleveland, Ohio, July 19, 1922.

Hon. Commissioner of Patents,
D Washington, D. C.

Sir:

Enter the following claim as claim 11.

11. In a piston for an internal combustion engine, the combination of a piston head having a depending ring flange, two pairs of curved guide members oppositely disposed with relation to the axis of the piston, the curved members of each pair thereof being separated
D¹ from the ring flange and from each other by con-
Per G tinuous air gaps, wrist pin bosses and webs connecting the wrist pin bosses with certain of said guide members, said guide members piston head and webs being united in an integral [illegible] tary structure.

Insert
E[1]

[fol. 2061] REMARKS.

Claim 11 presented herewith resembles allowed claim 1, closely, and it is believed to be allowable. An early allowance is requested.

Respectfully,

B. D. WATTS.
364997—40

(Patent Office Oct 5 1922 Mailed)

2—260

Div. 12 Room 322 **Paper No. 14**

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.

All communications respecting this application should give the serial number, date of filing, title of invention, and name of the applicant.

Ch-D

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington Oct. 5, 1922

B. D. Watts,
451 Lennox Bldg.,
East 9th St. & Euclid Ave.,
Cleveland, Ohio.

Please find below a communication from the Examiner in charge of the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS.

THOMAS E. ROBERTSON,
Commissioner of Patents.

Amended July 21, 1922.

Claims 1, 2, 3, 6 and 11 are allowed.

Claims 4, 5, 7, 8, 9 and 10 are again rejected upon the references and for the reasons given in the last office action.

Referring to applicant's remarks submitted June 15, 1922, it is thought that the arguments and authorities

[fol. 2062] therein set forth are not in point with the issue now being discussed relative to the case at bar. The Examiner has never contended that the various claims in a case should be patentably different from each other in the sense that claims in different applications are required to be different. But, the Examiner does maintain, that where a claim clearly and completely sets forth the applicant's contribution to the art to which his invention appertains, no good reason is seen, and none has been advanced for allowing a large number of claims, which not only do not include anything new and patentable in addition to the novel feature, already covered, but do not even describe the novel and patentable feature itself in slightly different terms. In the present case applicant is attempting to add old and unpatentable features to his invention for which he has already been

granted protection by the allowed claims.

If the rejected claims are allowable they are so not because they include "cordal webs" (as against "webs" set forth in claim 3), or because the "webs" extend downwardly from the head, (whereas claim 3 only states that the webs are "integral with the head") or because the skirt is "integrally connected to each of the side edges of the webs," or because the "webs are substantially rectangular in shape" or because the "skirt extends beyond the webs."

Not any of the above structural limitations, taken singly or in the aggregate, which characterize the chief difference between the allowed and rejected claims, are patentable over Ricardo, of record. For, it is to be noted that Ricardo shows a piston whose head and skirt are separated from each other by circumferential slots, a plurality or a pair of cordal webs integrally with and extending downwardly from the head, said webs being in parallel relation to each other, and having opposed wrist pin bosses, said webs being rectangular in shape and having joined thereto at their side edges the skirt of the piston which skirt extends below the said webs. Applicant's only contribution to the art, as developed by Ricardo, is the splitting of the guide sections or slippers. For this he has ample protection in the allowed claims.

As heretofore stated, it is thought to be well settled in

the law that a claim to be properly allowable must define something novel and patentable over what forms the basis [fol. 2063] for patentability in the allowed claims. To do otherwise would be to invite controversy and litigation.

The foregoing considerations dispose of the issue in the case and as the Examiner is firmly of the opinion that the rejection of May 6, 1922 was proper, the same

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450,899—3

is made final from which applicant may appeal to the board of Examiners-in-Chief if he so desires.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—43

(Patent Office Apr 5-1923 Mailed)

2—260

Div. 12 Room 322 **Paper No. 15**

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.

All communications respecting this application should give the serial number, date of filing, title of invention, and name of the applicant.

Ch-D

Copy sent applicant and assignee.

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE

Washington, April 5, 1923.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a communication from the Examiner in charge of the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898 Pistons.

45—9–10–11

THOMAS E. ROBERTSON,
Commissioner of Patents.

[fol. 2064] The following claims are suggested to the applicant for the purpose of interference:

—A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses connected to the head and to the upper and lower parts of the skirt, said skirt being split longitudinally at one side between its connections to said bosses.

A piston comprising a head portion, a skirt portion, two separated pin bosses, connecting flanges in the zone of the bosses and extending from the bosses to the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the skirt portion being entirely separated from the head portion except through the boss connections, and the skirt portion being split longitudinally of the piston to permit free expansion and contraction.

A piston comprising a head portion, a skirt portion, two separated pin bosses, connecting flanges in the zone of the bosses and extending from the bosses to the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the skirt portion being entirely separated from the head portion except through the boss connections, and the skirt portion being split longitudinally of the piston to permit free expansion and contraction and the skirt portion being cut away adjacent the outer ends of the piston bosses.

A piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having on one side a cylinder-engaging part disposed to take the angular thrust of a connecting rod during one stroke of the piston, said cylinder-engaging part being separated at its upper end from said side wall by an air gap and being split longitudinally to accommodate expansion incident to the heating of the piston, a pair of separated pin bosses, and walls integrally uniting said bosses, the guide portion and the head portion.

364997—44

450,898—2

A piston comprising a head and body, internal yielding ribs supporting the head and body, and means on said ribs

adapted to form engaging connection with operable parts for said piston.

A piston open at one end and having a packing ring supporting portion and a cylinder engaging portion, said cylinder engaging portion having a slot which is cut through [fol. 2065] the thickness of its peripheral wall and extending from the open end of the piston to said ring supporting portion, a pair of wrist pin bearings depended from said ring supporting portion separated from said cylinder engaging portion, and tying means extending from each of said wrist pin bearings each being co-operably connected at their opposite ends to said cylinder engaging portion.

A piston for internal combustion engines comprising a head having downwardly extending resilient arms carrying curved guide members, said head being of less diameter than the diameter of the guide members.

In a piston of the class described, a cup-like head comprising a pressure receiving end and a wall portion, a skirt circumferentially disconnected from the wall portion of the head and divided from end to end, and skirt carriers connecting said skirt to the pressure receiving end, said skirt carriers being disconnected from the wall portion of the head and susceptible of being slightly flexed radially.

A piston having a head with top and side walls in combination with a guide structure connected thereto and comprising diametrically opposite cylinder-engaging parts formed with air spaces between their upper edges and the bottom edge of the side wall of the head, wrist pin bosses between the cylinder-engaging parts, and means joining said bosses and cylinder-engaging parts together, the said joining means being resiliently yieldable and arranged not to engage the cylinder.

A piston having a head and a cross-head structure connected thereto and comprising diametrically opposite slippers, wrist pin bosses between the slippers and means joining said bosses and slippers together, the said joining means being resiliently yieldable.

A piston comprising a head, a skirt having resilient sections separated from said head by a slit extending continuously around the piston, and means for yieldingly connecting said skirt sections with said head.

Failure to make the above claims within thirty days from

the date of mailing of this letter will be taken as a disclaimer of the subject matter covered thereby.

R. M. WEAVER,
Acting Examiner, Div. 12.

V. I. C.

364997—45

[fol. 2066] (Mail Room May 3 1923 U. S. Patent Office)

Division 12, **Paper No. 16**
May 4 1923
U. S. Patent Office

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Applicant Frank Jardine
Invention Pistons
Serial No. 450,898
Filed March 9, 1921

E Cleveland, Ohio, April 30th, 1923.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:—

In response to the Official Action dated April 5, 1923 in which certain claims were suggested to applicant for purpose of interference, applicant amends as follows:

Insert the following claims as Claims 11 to 21 inclusive.

E' [11.]* **12E** A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses connected to the head and to the upper and lower parts of the skirt, said skirt being split longitudinally at one side between its connections to said bosses.

Per G [12.]* **13E** A piston comprising a head portion, a skirt portion, two separated pin bosses, connect-

[*Matter enclosed in brackets struck out in copy.]

ing flanges in the zone of the bosses and extending from the bosses to the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the skirt portion being entirely separated from the head portion except through the boss connections, and the skirt portion being split longitudinally of the piston to permit free expansion and contraction.

—1— 364997—46

[13.]* **14E** A piston comprising a head portion, a skirt portion, two separated pin bosses, connecting flanges in the zone of the bosses and extending from the bosses to [fol. 2067] the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the skirt portion being entirely separated from the head portion except through the boss connections, and the skirt portion being split longitudinally of the piston to permit free expansion and contraction and the skirt portion being cut away adjacent the outer ends of the piston bosses.

[14.]* **15E** A piston for internal combustion engines comprising in combination a head portion having an end wall and a side wall, a guide portion having on one side a cylinder-engaging part disposed to take the angular thrust of a connecting rod during one stroke of the piston, said cylinder-engaging part being separated at its upper end from said side wall by an air gap and being split longitudinally to accommodate expansion incident to the heating of the piston, a pair of separated pin bosses, and walls integrally uniting said bosses, the guide portion and the head portion.

[15.]* **16E** A piston comprising a head and body, internal yielding ribs supporting the head and body, and means on said ribs adapted to form engaging connection with operable parts for said piston.

[16.] **17E** A piston open at one end and having a packing ring supporting portion and a cylinder engaging portion, said cylinder engaging portion having a slot which is cut through the thickness of its peripheral wall and extending from the open end of the piston to said ring supporting portion, a pair of wrist pin bearings depended from said ring supporting portion **and** separated from said cylinder en-

[* Matter enclosed in brackets, struck out in copy.]

gaging portion, and tying means extending from each of said wrist pin bearings each being co-operably connected at their opposite ends to said cylinder engaging portion.

—2— 364997—47

[17.]* **18E** A piston for internal combustion engines comprising a head having downwardly extending resilient arms carrying curved guide members, said head being of less diameter than the diameter of the guide members.

[18.]* **19E** In a piston of the class described, a cup-like head comprising a pressure receiving end and a wall portion, a skirt, circumferentially disconnected from the wall portion of the head and divided from end to end, and skirt carriers connecting said skirt to the pressure receiving end, said skirt carriers being disconnected from the wall portion of the head and susceptible of being slightly flexed radially.

[fol. 2068] [19.]* **20E** A piston having a head with top and side walls in combination with a guide structure connected thereto and comprising diametrically opposite cylinder-engaging parts formed with air spaces between their upper edges and the bottom edge of the side wall of the head, wrist pin bosses between the cylinder-engaging parts, and means joining said bosses and cylinder-engaging parts together, the said joining means being resiliently yieldable and arranged not to engage the cylinder.

[20.]* **21E** A piston having a head and a cross-head structure connected thereto and comprising diametrically opposite slippers, wrist pin bosses between the slippers and means joining said bosses and slippers together, the said joining means being resiliently yieldable.

[21.]* **22E** A piston comprising a head, a skirt having resilient sections separated from said head by a slit extending continuously around the piston, and means for yieldingly connecting said skirt sections with said head.

REMARKS.

Kindly note a change of address of applicant's attorney from 451 Lennox Building, East 9th and Euclid

[*Matter enclosed in brackets struck out in copy.]

Avenue to 1213 Ulmer Building, both in Cleveland, Ohio.

B. D. WATTS,
Attorney for Applicant.

INTERFERENCE.

["A"]* (1)

Interference No. 49569 **Paper No. 17**
Name, Frank Jardine,
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921
Interference with R. E. Day; G. A. Taylor, H. E. Maynard; S. D. Hartog; E. C. Long and E. J. Gulick.

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, **Adverse**	Dated, **June 2/24**
Board,	Dated,
Commissioner,	Dated,

[fol. 2069] REMARKS:

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.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner

364997—50

[*Matter enclosed in brackets struck out in copy.]

(U. S. Patent Office Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 18
[Interference.]
["A"]* (1)

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Leanox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS.

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49569

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is [fol. 2070] Count.

1. A piston for internal combustion engine comprising in combination a head portion having an end wall and a side wall, a guide portion having on one side a cylinder-engaging part disposed to take the angular thrust of a connecting rod

[* Matter enclosed in brackets, struck out in copy.]

during one stroke of the piston, said cylinder-engaging part being separated at its upper end from said side wall by an air gap and being split longitudinally to accommodate expansion incident to the heating of the piston, a pair of separated pin bosses, and walls integrally uniting said bosses, the guide portion and the head portion.

This interference involves your application above identified and an application for PISTONS, filed by Ray E. Day, of 3825 North 24th St., Tacoma, Wash., whose attorney is Clarence E. Mehlhope, of Marquette Bldg., Chicago, Ill.,

An application for PISTONS, filed by George A. Taylor, of 164 Dana Avenue, Hyde Park, Mass., whose attorney is Macleod, Calver, Copeland and Dike, of Tremont Bldg., Boston, Mass.,

An application for PISTONS, filed by Howard E. Maynard, of 700 Calvert Avenue, Detroit, Michigan, whose

364997—51

450,898—2

attorney is Whittemore, Hulbert & Whittemore, of Penobscot Bldg., Detroit, Michigan,

An application for PISTONS, filed by Stephen D. Hartog, of 3219 Natural Bridge Avenue, St. Louis, Mo., whose attorney is Rippey and Kingsland, of The Rialto Bldg., St. Louis, Mo.,

An application for INTERNAL COMBUSTION ENGINE PISTONS filed by Elmer C. Long, of 1037 Main St., Quincy, Illinois, whose attorney is Herbert G. Fletcher, of 321 International Life Bldg., % Knight Bros., St. Louis, Missouri, and

An application for PISTONS, filed by Edward J. Gulick, of P. O. Box 553, Elkhart, Indiana, whose attorney is Milton Tibbetts, of % Packard Motor Car Company, Detroit, Michigan, and whose assignee is the Cleveland Trust Company, of Cleveland, Ohio, a corporation of Ohio.

[fol. 2071] The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Gulick	Hartog	Jardine	Long	Maynard	Taylor
1	14	15	30	15	10	12	13.

adverse

V. I. C.

P. P. PIERCE,
Examiner, Div. 12.

364997—52

["B"]* (2)

INTERFERENCE.

Paper No. 19

Interference No. 49570
Name, Frank Jardine
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921

Interference with R. E. Day; G. A. Taylor; E. C. Long; H. E. Maynard; S. D. Hartog and E. J. Gulick

DECISIONS OF

Prima Examiner,	Dated,
Ex'r of Interferences, **Adverse**	Dated, **Apr. 8/24**
Board,	Dated,
Commissioner,	Dated,

REMARKS:

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—53

(U. S. Patent Office Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 20
[INTERFERENCE.]
["B"]* (2)

[* Matter enclosed in brackets, struck out in copy.]

[fol. 2072] DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington, D. C.

Copy sent assignee

B. D. Watts,
451 Lennox Bldg., East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS, **Renewal of application filed March 11, 1920, Ser. No. 364,997.**

Very respectfully,

THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49570

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug 27 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count.

1. A piston comprising a head and body, internal yielding ribs supporting the head and body, and means on said ribs adapted to form engaging connection with operable parts for said piston.

This interference involves your application above identified and an application for PISTONS, filed by Ray E. Day, of 3825 North 24th St., Tacoma, Wash., whose attorney is Clarence E. Mehlhope, of Marquette Bldg., Chicago, Illinois,

An application for PISTONS, filed by George A. Taylor, 164 Dana Ave., Hyde Park, Mass., whose attorney is Macleod,

Calver, Copeland & Dike, of Tremont Bldg., Boston, Mass., [fol. 2073] An application for PISTON FOR AN INTERNAL COMBUSTION MOTOR, filed by Elmer C. Long, of 4834 Beaubien St., Detroit, Michigan, whose attorney is Herbert G. Fletcher, of 1111 International Life Bldg., St. Louis, Mo.,

364997—54

450,898—2

An application for PISTONS, filed by Howard E. Maynard, of 700 Calvert Ave., Detroit, Michigan, whose attorney is Whittemore, Hulbert, & Whittemore, of Penobscot Bldg., Detroit, Mich.,

An application for PISTONS, filed by Stephen D. Hartog, of 3219 Natural Bridge Ave., St. Louis, Mo., whose attorney is Rippey & Kingsland, of The Rialto Bldg., St. Louis, Mo., and

An application for PISTONS, filed by Edward J. Gulick, of P. O. Box 553, Elkhart, Indiana, whose attorney is Milton Tibbetts, of c/o Packard Motor Car Company, Detroit, Michigan, and whose assignee is the Cleveland Trust Company, of Cleveland, Ohio, a corporation of Ohio.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Hartog	Gulick	Jardine	Long	Maynard	Taylor
1	15	1	30	16	13	13	14.

P. P. PIERCE,
Examiner, Div. 12.

V.I.C.

364997—55

2—079

INTERFERENCE.

["C"]* (3)
Paper No. 21

Interference No. 49571
Name, Frank Jardine,
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921.
Interference with R. E. Day; G. A. Taylor; A. Spillman; H. E. Maynard; E. C. Long; E. J. Gulick (Kelm added)

[* Matter enclosed in brackets struck out in copy.]

[fol. 2074] DECISIONS OF

Primary Examiner, Dated,
Ex'r of Interferences, **Adverse** Dated, **June 2/24**
Board, Dated,
Commissioner, Dated,

REMARKS:

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—56

(U. S. Patent Office Jul. 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.

Paper No. 22
[INTERFERENCE.]

June 15, 1923
Ch-D

["C"]* (3)

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS, **renewal of application filed March 11, 1920, Ser. No. 364,997.**

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

[*Matter enclosed in brackets struck out in copy.]

[fol. 2075] Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49571

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count.

1. A piston open at one end and having a packing ring supporting portion and a cylinder engaging portion, said cylinder engaging portion having a slot which is cut through the thickness of its peripheral wall and extending from the open end of the piston to said ring supporting portion, a pair of wrist pin bearings depended from said ring supporting portion and separated from said cylinder engaging portion, and tying means extending from each of said wrist pin bearings each being cooperably connected at their opposite ends to said cylinder engaging portion.

This interference involves your application above identified and an application for PISTONS, filed by Ray E. Day, of 3825 North 24th St., Tacoma, Wash., whose attorney is Clarence E. Mehlhope, of Marquette Bldg., Chicago, Ill.,

An application for PISTONS. filed by George A. Taylor, of 164 Dana Ave., Hyde Park, Mass., whose attorney is Macleod, Calver, Copeland and Dike, of Tremont Bldg., Boston, Mass.,

An application for ENGINE PISTONS, filed by Albert Spillman, of 261 Payne Ave., North Tonawanda, N. Y.,

364997—57

450,898—2

whose attorney is Geyer & Popp, of 619 Brisbane Bldg., Buffalo, N. Y.,

An application for PISTONS, filed by Howard E. Maynard, of 700 Calvert Avenue, Detroit, Michigan, whose attorney is

Whittemore, Hulbert & Whittemore, of Penobscot Bldg., Detroit, Michigan,

[fol. 2076] An application for PISTON filed by Elmer C. Long, of 1037 Main Street, Quincy, Illinois, whose attorney is Herbert G. Fletcher, of International Life Bldg., St. Louis, Mo., and

An application for PISTONS, filed by Edward J. Gulick, of P. O. Box 553, Elkhart, Ind., whose attorney is Milton Tibbetts, of c/o Packard Motor Car Co., Detroit, Michigan, whose assignee is the Cleveland Trust Company, of Cleveland, Ohio, a corporation of Ohio.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Gulick	Jardine	Long	Maynard	Spillman	Taylor
1	16	31	17	1	14	13	15.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—58

2-079

INTERFERENCE.

["D"]* (4)

Interference No. 49572 **Paper No. 23**
Name, Frank Jardine,
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921
Interference with E. J. Gulick; E. C. Long; S. D. Hartog, H. E. Maynard; A. Spillman and G. A. Taylor

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, **Adverse**	Dated, **Apr. 10/24**
Board,	Dated,
Commissioner,	Dated,

[*Matter enclosed in brackets struck out in copy.]

REMARKS:

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

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[fol. 2077] (U. S. Patent Office Jul 7 1923 Mailed)

2-213

Forwarded from 12 Div. to
Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 24
[INTERFERENCE.]
["D"]* (4)

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee,

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS **renewal of application filed March 11, 1920, Ser. No. 364,997.**

Very respectfully,

THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49572

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

[*Matter enclosed in brackets struck out in copy.]

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count.

1. A piston having a head with top and side walls in combination with a guide structure connected thereto and comprising diametrically opposite cylinder-engaging parts formed with air spaces between their upper edges and the [fol. 2078] bottom edge of the side wall of the head, wrist pin bosses between the cylinder-engaging parts, and means joining said bosses and cylinder-engaging parts together, the said joining means being resiliently yieldable and arranged not to engage the cylinder.

This interference involves your application above identified and an application for PISTONS, filed by George A. Taylor, of 164 Dana Ave., Hyde Park, Mass., whose attorney is Macleod, Calver, Copeland & Dike, of Tremont Bldg., Boston, Mass.

An application for ENGINE PISTONS, filed by Albert Spillman, of 261 Payne Ave., North Tonawanda, N. Y., whose attorney is Geyer & Popp, of 619 Brisbane Bldg., Buffalo, New York.

An application for PISTONS, filed by Howard E. Maynard, of 700 Calvert Ave., Detroit, Michigan, whose attorney is Whittemore, Hulbert & Whittemore, of Penobscot Bldg., Detroit, Mich.

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450,898—2

An application for PISTONS, filed by Stephen D. Hartog, of 3219 Natural Bridge Ave., St. Louis, Missouri, whose attorney is Rippey & Kingsland, of The Rialto Bldg., St. Louis, Mo.,

An application for PISTONS FOR INTERNAL COMBUSTION MOTORS filed by Elmer C. Long, of 1037 Main St., Quincy, Illinois, whose attorney is Herbert G. Fletcher, of c/o Knight Bros., 321 International Life Bldg., St. Louis, Mo., and

An application for PISTONS, filed by Edward J. Gulick, of P. O. Box 553, Elkhart, Indiana, whose attorney is Milton Tibbetts, of c/o Packard Motor Car Company, Detroit,

Mich., whose assignee is the Cleveland Trust Company, of Cleveland, Ohio, a corporation of Ohio.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Gulick	Hartog	Jardine	Long	Maynard	Spillman	Taylor
1	32	24	20	7	15	16	16.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—61

[fol. 2079] 2—079

INTERFERENCE.

["E"]* (5)
Paper No. 25

Interference No. 49573
Name, Frank Jardine
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921
Interference with E. J. Gulick; E. C. Long; H. E. Maynard; Stephen D. Hartog and R. E. Day

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, Adverse	Dated, Apr. 10/24
Board,	Dated,
Commissioner,	Dated,

REMARKS:

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—62

[*Matter enclosed in brackets struck out in copy.]

(U. S. Patent Office. Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences. June 15, 1923

Paper No. 26
[Interference.]
#["E"]* (5)

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, [fol. 2080] Filed Mar. 9, 1921, Serial No. 450,898, Pistons, **renewal of application filed March 11, 1920, Ser. No. 364,997.**

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49573

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count.

1. A piston comprising a head, a skirt separated at its periphery from the head, and pin bosses connected to the

[*Matter enclosed in brackets struck out in copy.]

head and to the upper and lower parts of the skirt, said skirt being split longitudinally at one side between its connections to said bosses.

This interference involves your application above identified and an application for PISTONS, filed by Ray E. Day, of 3825 North 24th St., Tacoma, Wash., whose attorney is Clarence E. Mehlhope of Marquette Bldg., Chicago, Ill.,

An application for PISTONS, filed by Howard E. Maynard, of 700 Calvert Ave., Detroit, Mich., whose attorney is Whittemore, Hulbert & Whittemore, of Penobscot Bldg., Detroit, Mich.,

An application for PISTONS, filed by Stephen D. Hartog, of 3219 Natural Bridge Avenue, St. Louis, Mo., whose attorney is Rippey & Kingsland, of The Rialto Bldg., St. Louis, Mo.,

364997—63

450,898—2

An application for INTERNAL COMBUSTION ENGINE PISTONS, filed by Elmer C. Long, of 1037 Main St., Quincy, Illinois, whose attorney is Herbert G. Fletcher, of 321 International Life Bldg., c/o Knight Bros., St. Louis, Mo., and

[fol. 2081] An application for PISTONS, filed by Edward J. Gulick, of P. O. Box 553, Elkhart, Indiana, whose attorney is Milton Tibbetts, of c/o Packard Motor Car Company, Detroit, Michigan, and whose assignee is the Cleveland Trust Company, of Cleveland, Ohio, a corporation of Ohio.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Gulick	Hartog	Jardine	Long	Maynard
1	10	1	28	12	8	8

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—64

[*Matter enclosed in brackets struck out in copy.]

2—079

INTERFERENCE. ["H"]* (8)

Interference No. 49576 Paper No. 27
Name, Frank Jardine,
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921
Interference with E. J. Gulick; H. E. Maynard; E. C. Long; R. E. Day

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, Adverse	Dated, Apr. 10/24
Board,	Dated,
Commissioner,	Dated,

REMARKS:

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This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—65

[fol. 2082] (U. S. Patent Office Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences June 15, 1923 Ch-D

Paper No. 28
[INTERFERENCE.]
["H"]* (8)

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine,

[*Matter enclosed in brackets struck out in copy.]

Filed Mar. 9, 1921, Serial No. 450,898, Pistons, original filed March 11, 1920, Ser. No. 364,997.

Very respectfully,

THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49576

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug 27 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count.

1. A piston comprising a head portion, a skirt portion, two separated pin bosses, connecting flanges in the zone of the bosses and extending from the bosses to the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the skirt portion being entirely [fol. 2083] separated from the head portion except through the boss connections, and the skirt portion being spilt longitudinally of the piston to permit free expansion and contraction and the skirt portion being cut away adjacent the outer ends of the piston bosses.

This interference involves your application above identified and an application for Pistons, filed by Ray E. Day, of 3825 North 24th St., Tacoma, Wash., and whose attorney is Clarence E. Mehlhope, of Marquette Bldg., Chicago, Illinois,

An application for Pistons, filed by Elmer C. Long, of 4834 Beaubien St., Detroit, Mich., and whose attorney is Herbert G. Fletcher of International Life Bldg., St. Louis, Mo.,

An application for Pistons, filed by Howard E. Maynard,

of 700 Calvert Ave., Detroit, Michigan, and whose attorney is Whittemore, Hulbert & Whittemore, of Pe-

364997—66

450,898—2

nobscot Bldg., Detroit, Michigan, and

An application for Pistons, filed by Edward J. Gulick, of P. O. Box 553, Elkhart, Indiana, and whose attorney is Milton Tibbetts, of c/o Packard Motor Car Co., Detroit, Michigan, and whose assignee is the Cleveland Trust Company, a corporation of Ohio.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Gulick	Jardine	Long	Maynard
1	12	12	14	11	10

P. P. PIERCE,
Examiner, Div. 12.

V.I.C.

364997—67

2—079

INTERFERENCE. ["I"]* (9)

Interference No. 49577 **Paper No. 29**
Name, Frank Jardine,
Serial No. 450,898
Title, Pistons
Filed, Mar. 9, 1921
Interference with E. J. Gulick; E. C. Long; H. E. Maynard & R. E. Day

[fol. 2084]

DECISIONS OF

Primary Examiner,		Dated,
Ex'r of Interferences,	**Adverse**	Dated, **Dec. 20, 1923**
Board,		Dated,
Commissioner,		Dated,

REMARKS:

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[*Matter enclosed in brackets struck out in copy.]

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—68

(U. S. Patent Office Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 30
[INTERFERENCE.]
["I"] (9)

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, Pistons, original filed Mar. 11, 1920, Ser. No. 364,997.

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49577

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.
[fol. 2085] The statement demanded by Rule 110 must be sealed up and filed on or before Aug 27 1923, with the sub-

ject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count

1. A piston comprising a head portion, a skirt portion, two separated pin bosses, connecting flanges in the zone of the bosses and extending from the bosses to the skirt on both sides of the bosses, connecting means from each of the bosses to the head portion, the skirt portion being entirely separated from the head portion except through the boss connections, and the skirt portion being split longitudinally of the piston to permit free expansion and contraction.

This interference involves your application above identified and an application for Pistons, filed by Ray E. Day of 3825 North 24th St., Tacoma, Wash., and whose attorney is Clarence E. Mehlhope, of Marquette Bldg., Chicago, Ill.

An application for Pistons, filed by Howard E. Maynard, of 700 Calvert Ave., Detroit, Mich., and whose attorney is Whittemore, Hulbert & Whittemore, of Penobscot Bldg., Detroit, Mich.

An application for INTERNAL COMBUSTION ENGINE PISTONS, filed by Elmer C. Long, of 1037 Main St., Quincy, Ill., and whose attorney is Herbert G. Fletcher, of 321

364997—69

450,898—2

International Life Bldg., c/o Knight Bros., St. Louis, Mo., and

An application for Pistons, filed by Edward J. Gulick, of P. O. Box 553, Elkhart, Indiana, whose attorney is Milton Tibbetts, c/o Packard Motor Car Company, Detroit, Mich., and whose assignee is The Cleveland Trust Company, of Cleveland, Ohio, a corporation of Ohio.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Gulick	Jardine	Long	Maynard
1	11	11	13	9	9

V. I. C.

P. P. PIERCE,
Examiner, Div. 12.

364997—70

810

[fol. 2086] 2—079

INTERFERENCE ["J"]* (10)

Interference No. 49578 Paper No. 31
Name, Frank Jardine,
Serial No. 450,898
Title, Pistons
Filed, Mar. 9, 1921
Interference with E. C. Long; S. D. Hartog; A. Spillman; R. E. Day

DECISIONS OF

[Primary]* Law Examiner, Interference dissolved	Dated,	Apr 4 1924
Ex'r of Interferences, Adverse	Dated,	Dec 30/25
Board, "	Dated,	Nov. 10/24
Commissioner, Affirmed	Dated,	Oct 26 1927
Court "	"	Jany 13/30

REMARKS:

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—71

(U. S. Patent Office Jul 7 1923 Mailed)
2—213

Forwarded from 12 Div. to Examiner of Interferences. June 15, 1923

Paper No. 32
[INTERFERENCE.]
["J"]* (10)

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine,

[* Matter enclosed in brackets struck out in copy.]

[fol. 2087] Filed Mar. 9, 1921, Serial No. 450,898, PISTONS, original filed Mar. 11, 1920, Ser. No. 364,997.

Very respectfully,

THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49578

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count.

1. In a piston of the class described, a cup-like head comprising a pressure receiving end and a wall portion, a skirt circumferentially disconnected from the wall portion of the head and divided from end to end, and skirt carriers connecting said skirt to the pressure receiving end, said skirt carriers being disconnected from the wall portion of the head and susceptible of being slightly flexed radially.

This interference involves your application above identified and an application for PISTONS, filed by Ray E. Day, of 3825 North 24th St., Tacoma, Wash., and whose attorney is Clarence E. Mehlhope, of Marquette Bldg., Chicago, Ill.,

An application for ENGINE PISTONS, filed by Albert Spillman, of 261 Payne Ave., North Tonawanda, N. Y., whose attorney is Geyer & Popp, of 619 Brisbane Bldg., Buffalo, N. Y.,

An application for PISTONS, filed by Stephen D. Hartog, of 3219 Natural Bridge Ave., St. Louis, Mo., and whose attorney is Rippey & Kingsland, of The Rialto Bldg., St. Louis, Mo., and

364997—72

[fol. 2088] 450,898—2

An application for INTERNAL COMBUSTION ENGINE PISTONS, filed by Elmer C. Long, of 1037 Main St., Quincy, Illinois,

and whose attorney is Herbert G. Fletcher, of 321 International Life Bldg., % Knight Bros., St. Louis, Mo.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Spillman	Hartog	Jardine	Long
1	17	15	10	19	12.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—73

2—079

INTERFERENCE.

["K"]* (11)
Paper No. 33

Interference No. 49579
Name, Frank Jardine
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921.
Interference with E. C. Long; S. D. Hartog; A. Spillman.

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, **Adverse**	Dated, **Sept. 3/24**
Board,	Dated,
Commissioner,	Dated,

REMARKS:

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—74

[fol. 2089] (U. S. Patent Office Jul 7 1923 Mailed)

2—213

[* Matter enclosed in brackets struck out in copy.]

Forwarded from 12 Div. to
Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 34
[INTERFERENCE.]
"K"

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898; PISTONS, **renewal of appln. filed March 11/20, No. 364,997.**

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49579

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Count.

1. A piston for internal combustion engines comprising a head having downwardly extending resilient arms carrying curved guide members, said head being of less diameter than the diameter of the guide members.

[fol. 2090] This interference involves your application above identified and an application for ENGINE PISTONS,

filed by Albert Spillman, of 261 Payne Ave., North Tonawanda, New York, and whose attorney is Geyer & Popp, of 619 Brisbane Bldg., Buffalo, N. Y.,

An application for PISTONS, filed by Stephen D. Hartog, of 3219 Natural Bridge Ave., St. Louis, Mo., and whose attorney is Rippey & Kingsland, of The Rialto Bldg., St. Louis, Mo., and

An application for INTERNAL COMBUSTION ENGINE PISTONS, filed by Elmer C. Long, of 1037 Main St., Quincy, Ill., and whose attorney is Herbert G. Fletcher, of 321 International Life Bldg., % Knight Bros., St. Louis, Mo.

364997—75

450898—2

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Hartog	Jardine	Long	Spillman
1	8	18	11	14.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—76

2—079

["M"]* (13)

INTERFERENCE.

Interference No. 49581 **Paper No. 35**
Name, Frank Jardine,
Serial No. 450,898
Title, Pistons
Filed, Mar. 9, 1921
Interference with Stephen D. Hartog: Elmer C. Long.

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, **Adverse**	Dated, **Apr 8/24**
Board,	Dated,
Commissioner,	Dated,

[* Matter enclosed in brackets struck out in copy.]

[fol. 2091] REMARKS:

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—77

(U. S. Patent Office Jul. 7 1923 Mailed)

2-213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923

Paper No. 36
[Interference.]
"M"

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed March 9, 1921, Serial No. 450,898, Pistons.

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49581

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the en- [fol. 2092] velope. The subject-matter involved in the interference is

Count.

1. A piston having a head and a cross-head structure connected thereto and comprising diametrically opposite slippers, wrist pin bosses between the slippers and means joining said bosses and slippers together, the said joining means being resiliently yieldable.

This interference involves your application above identified and an application for Pistons, filed by Stephen D. Hartog, of 3219 Natural Bridge Ave., St. Louis, Mo., and whose attorney is Rippey & Kingsland, of The Rialto Bldg., St. Louis, Mo., and

An application for Pistons for Internal Combustion Motors, filed by Elmer C. Long, of 1037 Main St., Quincy, Illinois, whose attorney is Herbert G. Fletcher, of c/o Knight Bros., 321 International Life Bldg., St. Louis, Mo.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Hartog	Jardine	Long
1	7	21	8

V. I. C.

P. P. PIERCE,
Examiner, Div. 12.

364997—78

2—079

INTERFERENCE.

["N"]* (14)
Paper No. 37

Interference No. 49582
Name, Frank Jardine
Serial No. 450,898
Title, Pistons
Filed, Mar. 9, 1921
Interference with H. E. Maynard: R. E. Day

[* Matter enclosed in brackets struck out in copy.]

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, **Favorable**	Dated, **Nov 19/23**
Board,	Dated,
Commissioner,	Dated,

[fol. 2093] REMARKS:

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—79

(U. S. Patent Office Jul. 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 38
[Interference.]
["N"]* **(14)**

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, filed Mar. 9, 1921, Serial No. 450,898, Pistons, **original filed Mar. 11, 1920, Ser. No. 364,997.**

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

[* Matter enclosed in brackets struck out in copy.]

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49582

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

[fol. 2094] Count.

1. In a piston for an internal combustion engine, the combination of a head having ring grooves therein, a plurality of webs integral with said head and having diametrically opposite piston pin bosses therein, a skirt integral with said webs relieved adjacent said webs and separated from the head by circumferential slots and provided with a longitudinal slot connecting the lower end of the piston with one of the circumferential slots.

This interference involves your application above identified and an application for Pistons, filed by Ray E. Day, of 3825 North 24th St., Tacoma, Wash., and whose attorney is Clarence E. Mehlhope, of Marquette Bldg., Chicago, Ill., and

An application for Pistons, filed by Howard E. Maynard, of 700 Calvert Aye., Detroit, Mich., and whose attorney is Whittemore, Hulbert & Whittemore, of Penobscot Bldg., Detroit, Mich.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Day	Jardine	Maynard
1	19	3	17

V. I. C.

P. P. PIERCE,
Examiner, Div. 12.

2—079

INTERFERENCE.

["O"]* (15)

Interference No. 49583 — Paper No. 39

Name, Frank Jardine
Serial No. 450,898
Title, Pistons

Filed, Mar. 9, 1921
Interference with S. D. Hartog; Albert Spillman

DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences,	Dated,
Board,	Dated,
Commissioner,	Dated,

[fol. 2095] REMARKS

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—81

(U. S. Patent Office Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923

Paper No. 40
[Interference.]
["O"]* (15)

Ch-D

[* Matter enclosed in brackets, struck out in copy.]

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Copy sent assignee.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898—Pistons, **original filed Mar. 11, 1920, Ser. No. 364,997.**

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49583

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on [fol. 2096]. the envelope. The subject-matter involved in the interference is

Count.

1. A piston comprising a head, a skirt having resilient sections separated from said head by a slit extending continuously around the piston, and means for yieldingly connecting said skirt sections with said head.

This interference involves your application above identified and an application for Engine Pistons, filed by Albert Spillman, of 261 Payne Ave., North Tonawanda, N. Y., and whose attorney is Geyer & Popp, of 619 Brisbane Bldg., Buffalo, N. Y., and

An application for Pistons, filed by Stephen D. Hartog, of 3219 Natural Bridge Ave., St. Louis, Mo., and whose attorney is Rippey & Kingsland, of The Rialto Bldg., St. Louis, Mo.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Hartog	Jardine	Spillman
1	34	22	1

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—82

2—079

INTERFERENCE.

"U" (21)

Interference No. 49589 **Paper No. 41**
Name, Frank Jardine
Serial No. 450,898
Title, Pistons
Filed, Mar. 9, 1921
Interference with Howard E. Maynard

DECISIONS OF

Primary Examiner	Dated,
Ex'r of Interferences, **Favorable**	Dated, **Nov 19/23**
Board,	Dated,
Commissioner,	Dated,

[fol. 2097] REMARKS:

.....

.....

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—83

(U. S. Patent Office Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 42
[INTERFERENCE.]
"U"

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

B. D. Watts,
451 Lennox Bldg., East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, PISTONS, **renewal of appln. filed March 11, 1920, No. 364,997.**

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49589

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

[fol. 2098] Count.

1. In a piston for an internal combustion engine the combination of a head comprising a head disc and a peripheral flange having ring grooves therein, a pair of cordal webs, substantially rectangular in shape and located opposite each other in the piston, connected integrally at their upper edges

to the peripheral flange of the piston, diametrically opposite wrist pin bosses, one in each of said webs, a skirt for said piston integrally connected to each of the side edges of the webs and cut away so as to expose each of the rectangular webs and the piston pin bosses from the outside of the piston, said piston being provided with circumferential slots between the skirt and head and with a longitudinal slot extending from one of the circumferential slots to the open end of the piston.

This interference involves your application above identified and an application for PISTONS, filed by Howard E. Maynard, of 700 Calvert Ave., Detroit, Michigan, and whose attorney is Whittemore, Hulbert & Whittemore, of Penobscot Bldg., Detroit, Michigan.

The relation of the count of the interference to the claims of the respective parties is as follows:

Count	Jardine	Maynard
1	6	18

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—84

2—079

INTERFERENCE

"V" 22
Paper No. 43

Interference No. 49590
Name, Frank Jardine,
Serial No. 450,898
Title, PISTONS
Filed, Mar. 9, 1921
Interference with Elmer C. Long

[fol. 2099] DECISIONS OF

Primary Examiner,	Dated,
Ex'r of Interferences, Adverse	Dated, Apr. 8/24
Board,	Dated,
Commissioner,	Dated,

REMARKS:

. . . . . .

. . . . . .

This should be placed in each application or patent involved in interference in addition to the interference letters by Primary Examiner.

364997—85

(U. S. Patent Office Jul 7 1923 Mailed)

2—213

Forwarded from 12 Div. to Examiner of Interferences.
June 15, 1923
Ch-D

Paper No. 44
[INTERFERENCE.]
"V"

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

B. D. Watts,
451 Lennox Bldg.,
East 9th & Euclid Ave.,
Cleveland, Ohio.

Please find below a copy of a communication from the Examiner concerning the application of Frank Jardine, Filed Mar. 9, 1921; Serial No. 450,898, PISTONS, **renewal of appln. filed March 11/20 No. 364,997.**

Very respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Room No. 322

Address only
The Commissioner of Patents
Washington, D. C.

49590

The case, above referred to, is adjudged to interfere with others, hereafter specified, and the question of priority will be determined in conformity with the Rules.

[fol. 2100] The statement demanded by Rule 110 must be sealed up and filed on or before Aug. 27, 1923, with the subject of the invention, and name of party filing it, indorsed on the envelope. The subject-matter involved in the interference is

Counts.

1. In a piston for an internal combustion engine, the combination of a piston head having a depending ring flange, two pairs of curved guide members oppositely disposed with relation to the axis of the piston, the curved members of each pair thereof being separated from the ring flange and from each other by continuous air gaps, and webs carrying wrist pin bosses, the said curved members, piston head and webs being united in an integral unitary structure.

2. In a piston for an internal combustion engine, the combination of a piston head having a depending ring flange, two pairs of curved guide members oppositely disposed with relation to the axis of the piston, the curved members of each pair thereof being separated from the ring flange and from each other by continuous air gaps, wrist pin bosses and webs connecting the wrist pin bosses with certain of said guide members, said guide members piston head and webs being united in an integral unitary structure.

This interference involves your application above identified and an application for PISTONS FOR INTERNAL COMBUSTION MOTORS, filed by Elmer C. Long, of 1037 Main St., Quincy, Illinois, and whose attorney is Herbert G. Fletcher, of c/o Knight Bros., 321 International Life Bldg., St. Louis, Missouri.

364997—86

450,898—2

The relation of the counts of the interference to the claims of the respective parties is as follows:

Counts	Jardine	Long
1	1	9
2	11	10

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—87

[fol. 2101] (U. S. Patent Office Dec 3 1923 Mailed)

2—260

Div. 12 Room 322 Paper No. 45

Address only

"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.

Ch-D

All communications respecting this application should give the serial number date of filing, title of invention, and name of the applicant.

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington

Richey, Slough and Watts,
1213 Ulmer Building,
Cleveland, Ohio.

Please find below a communication from the Examiner in charge of the application of Frank Jardine, Filed Mar. 9, 1921, Serial No. 450,898, Pistons. Originally filed Mar. 11, 1920, Serial No. 364,997.

Thomas E. Robertson,
Commissioner of Patents.

49571

In accordance with the provisions of Rule 129, the application for patent filed by Gustave R. Kelm, whose post-office address is c/o Walker M. Levett Company, 417 East 23rd St., New York, New York, whose attorney is Clarence D. Kerr, of No. 5 Nassau Street, New York, New York, and whose assignee is the Walker M. Levett Company, of New York, New York, a corporation of New York, is hereby added to Interference No. 49571, between Day v. Taylor v. Spillman v. Maynard v. Jardine v. Long v. Gulick, to which

you are a party. The claim of Kelm's application corresponding to the count of the issue is

Count	Claim
1	7.

[fol. 2102] The new party only is given until the Dec. 31, 1923, day of ....., 19..., within which to file the preliminary statement required by Rule 110.

The issue of the interference remains unchanged.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—88

(U. S. Patent Office Dec 3 1923 Mailed)

2—260

Div. 12 Room 322 **Paper No.** [45]* **46**

Address only

"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.

Ch-D

All communications respecting this application should give the serial number, date of filing, title of invention, and name of the applicant.

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington

Richey, Slough and Watts,
1213 Ulmer Building,
Cleveland, Ohio.

Please find below a communication from the EXAMINER in charge of the application of Frank Jardine, Filed Mar. 3, 1921, Serial No. 450,898, Pistons originally filed Mar. 11, 1920, Serial No. 364,997.

THOMAS E. ROBERTSON,
Commissioner of Patents.

[*Matter enclosed in brackets, struck out in copy.]

49572

In accordance with the provisions of Rule 129, the application for patent filed by Gustav R. Kelm, whose post-office address is c/o Walker M. Levett Company, No. 417 East 23rd Street, New York, New York, whose attorney is Clarence D. Kerr, of No. 5 Nassau Street, New York, N. Y., [fol. 2103] and whose assignee is the Walker M. Levett Company, of New York, New York, a corporation of New York is hereby added to Interference No. 49572, between Taylor v. Spillman v. Maynard v. Jardine v. Hartog v. Long v. Gulick, to which you are a party. The claim of Kelm's application corresponding to the count of the issue is:

Count	Claim
1	8.

The new party only is given until the Dec 31 1923, day of ....., 19...., within which to file the preliminary statement required by Rule 110.

The issue of the interference remains unchanged.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—89

(U. S. Patent Office Dec 3 1923 Mailed)

2—260

Div. 12 Room 322 **Paper No. 47**

Address only

"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.
Ch-D

All communications respecting this application should give the serial number date of filing, title of invention, and name of the applicant.

DEPARTMENT OF THE INTERIOR

UNITED STATES PATENT OFFICE

Washington

(Copy sent Assignee)

Richey, Slough and Watts,
1213 Ulmer Building,
Cleveland, Ohio.

Please find below a communication from the EXAMINER in charge of the application of Frank Jardine, Filed March 9, 1921, Serial No. 450,898, originally filed March 11, 1920, Serial No. 364,997, Pistons.

THOMAS E. ROBERTSON,
Commissioner of Patents.

[fol. 2104] 49581

In accordance with the provisions of Rule 129, the application for patent filed by Gustav R. Kelm, whose post-office address is c/o Walker M. Levett Company, 417 East 23rd Street, New York, New York, whose attorney is Clarence D. Kerr, No. 5 Nassau Street, New York, New York, and whose assignee is the Walker M. Levett Company, of New York, New York, a corporation of New York, is hereby added to Interference No. 49581 between Jardine v. Hartog v. Long to which you are a party. The claims of Kelm's application corresponding to the count of the issue is:

Count	Claim
1	9.

The new party only is given until the Dec 31 1923 day of ....., 19...., within which to file the preliminary statement required by Rule 110.

The issue of the interference remains unchanged.

P. P. PIERCE,
Examiner, Div. 12.

V. I. C.

364997—90

(Mail Room Nov 5 1923 U. S. Patent Office)
(Docket Division Nov. 5 1923)

450,898—48
Doc

DEPARTMENT OF THE INTERIOR
UNITED STATES PATENT OFFICE
Washington, D. C.

Applicant —Frank Jardine
Invention —Pistons
Serial No. —364,997, Renewal No. 450,898
Filed —March 9, 1921
Div 12 —Room 322

Cleveland, O., Nov. 3, 1923.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:—

I hereby substitute in my place as attorneys in the above entitled case, the firm of Richey, Slough & Watts, Register No. 11,730, (a partnership composed of F. O. Richey, F. M. Slough, B. D. Watts and W. M. Hart), 1213 Ulmer Building, Cleveland, Ohio, with all the powers originally delegated to myself.

[fol. 2105] And I hereby request that this substitution apply to each of the interferences in which the said application is now involved, identified by number as follows:—

No. 49,569	No. 49,577
49,570	49,578
49,571	49,579
49,572	49,581
49,573	49,582
49,576	49,583
	49,589
	49,590

B. D. Watts,
Attorney of Record.

The foregoing substitution is hereby approved.
Aluminum Manufacturers, Inc.
By W. P. King,
President.
Assignee of Record

(U. S. I. R. Documentary Stamp 25 Cents.)

364997—91

(Mail Room Nov 12 1925 U. S. Patent Office)

(Docket Division Nov 17 1925 U. S. Patent Office)

Intf. No. 49578 T. B.
Briefs for Jardine Nov. 16/25 **450,898—49**
[49572 49569 T. B. 49589 dist.]*

IN THE UNITED STATES PATENT OFFICE

Applicant Frank Jardine
Application Pistons
Filed March 9, 1921
Serial No. 450,898
Docket No. 1977

Cleveland, Ohio,
November 10, 1925.

The Commissioner of Patents,
Washington, D. C.

Sir:

I hereby appoint the firm of Richey & Watts, 1983 Union Trust Bldg., Cleveland, Ohio, (composed of F. O. Richey and [fol. 2106] B. D. Watts), Register No. 11,730 as substitute attorneys with all of the powers originally given to me, in the above entitled application.

B. D. Watts,
Attorney of Record.

(U. S. I. R. Documentary Stamp 25 Cents.)

364997—92

(Mail Division Aug 13 1928 U. S. Patent Office)

9 49583 U. S. Patent Office
18 49578 Aug 14 1928
24 Division 12 Paper No. 50
Not ent.

[* Matter enclosed in brackets struck out in copy.]

IN THE UNITED STATES PATENT OFFICE

Applicant —Frank Jardine
Application —Pistons
Serial No. —450,898
Filed —March 9, 1921

Cleveland, Ohio,
August 7, 1928.

The Commissioner of Patents,
F Washington, D. C.
Sir:
Applicant hereby amends as follows:
Add the following claim—

A one piece piston comprising a head and a skirt, the skirt having boss carrying portions exteriorly relieved and arranged opposite each other and secured to the head by substantially rigid connectors to cause radially outward and inward movement of the portions under operation conditions of the piston, the skirt also having opposite bearing wall portions arranged between the said boss carrying portions and each separated from the head by a slot of greater circumferential length than the corresponding length of the said portions.

Per H.

Respectfully submitted,
FRANK JARDINE,
By RICHEY & WATTS,
His Attorneys.

[fol. 2107] REMARKS

Applicant makes the above claim which is Count 4 of Interference No. 56,380, Franquist vs. Covert.

The claim is Covert's claim 15 and Franquist's claim 31. Applicant has recently learned that an interference regarding this subject matter existed and has made the claim promptly upon learning of the same.

The claim reads upon the Jardine construction as follows: The head of the piston is shown at 1 and the skirt at 2. The

boss-carrying portions are shown at 6 which are relieved about the bosses. The boss-carrying portions are arranged opposite to each other and secured to the head by substantially rigid connectors to which the reference numerals 9 are attached and which cause the outward and inward movement of the skirt portions. The opposite bearing walls of the skirt portions are shown at 10, each of which is separated from the head by slots 11 which extend as is best shown in the upper left-hand corner of Fig. 1 beyond the bearing faces.

Respectfully submitted,
RICHEY & WATTS,
Applicant's Attorneys.
364997—94

(Mailed Feb 8 1930)

Div. 12 Room 380 260 CAK:JTE **Paper No. 51**

Address only
"The Commissioner of Patents,
Washington, D. C.,"
and not any official by name.

All communications respecting this application should give the serial number, date of filing, and name of the applicant

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE

Washington Feb. 8, 1930.

Please find below a communication from the Examiner in charge of this application.

THOMAS E. ROBERTSON,
Commissioner of Patents.

[fol. 2108]

Applicant: Frank Jardine,
Ser. No. 450,898 (Renewal)
Filed Mar. 9, 1921
For Pistons.

Richey & Watts,
1983 Union Trust Bldg.,
Cleveland, Ohio.

Interferences 49,569; 49,570; 49,571; 49,572; 49,573; 49,576; 49,577; 49,578; 49,579; 49,581; 49,583; and 49,590

having been decided adverse to the applicant, claims 1, and 11 to 22, inclusive, are *finally* rejected in accordance with the provisions of Rule 132.

P. P. PIERCE,
Examiner.

CAK

364997—95

I 900

(Chief Clerk May 8 30 U. S. Patent Office)

U. S. Patent Office
May 8 1930
Division 12, **Paper No. 52**

Applicant —Frank Jardine
Application—Pistons
Serial No. [—364,997]* **450,898**
Filed —March 9, 1921
Docket No. —1977

Division 12

Cleveland, Ohio, May 7, 1930.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

G In response to Official Action dated February 8, 1930 applicant amends as follows:

Claim 4, line 7, cancel "connecting" and substitute —*lying on a line extending from*—. Same line cancel "with" and substitute —*to*—.

Claim 5, line 5, after "webs" insert —*to expose said bosses.* Line 7 after "slot" insert —*lying on a line extending from*—.

Cancel Claims 1, and 11 to 22 inclusive.

[fol. 2109] Add the following claims:

[23.]* 3. An internal combustion engine piston comprising a head having a depending ring flange, webs in-

[*Matter enclosed in brackets struck out in copy.]

tegrally cast to the ring flange and depressed within
G[1] the circumference defined by the ring flange, wrist pin bosses cast in the webs, and curved guide means integrally cast to the webs and provided with a longitudinal slit disposed between the ends of the webs on one side of the piston, the outer surface of the guide means being disposed in a circumference outwardly of the outer surface of the webs and merging into the latter at included angles sufficiently great to permit the removal of a permanent mold part used to form the outer surface of the piston.

(over)

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I 901

[24.]* 4 In a piston for an internal combustion engine, the combination of a head having a depending circumferential flange provided with ring grooves on the exterior thereof, chordal webs integral with the head and depending therefrom in opposite positions, piston pin bosses, one located in each web opposite each other, a skirt portion cut away from the head to expose the bosses in the webs and provided with curved bearing faces integral with the webs and connected to the ends of the webs opposite each other, each of said bearing faces being separated from the head except for the integral connection through the webs and one of said bearing faces having a substantially vertical slot therein.

[25.]* 5 In a piston for an internal combustion engine, the combination of a head having a depending circumferential flange provided with ring grooves on the exterior thereof, chordal webs integral with the head and depending therefrom in opposite positions, piston pin bosses one located in each web opposite each other, ribs integral with and substantially perpendicular to the webs joining the webs and the head, a skirt portion cut away from the head to expose the bosses in the webs provided with curved bearing faces integral with the webs and connected to
53 the ends of the webs opposite each other, each of said bearing faces being separated from the head except for the integral connection through the webs and one of said bearing faces having a substantially vertical slot therein.

[*Matter enclosed in brackets struck out in copy.]

[fol. 2110] [26.]* 6. In a piston for an internal combustion engine, the combination of a head having a depending circumferential flange provided with ring grooves on the exterior thereof, chordal webs integral with the head and depending therefrom in opposite positions, piston pin bosses, one located in each web opposite each other, ribs integral with and substantially perpendicular to the webs joining the webs, the bosses and the head together, a skirt portion cut away from the head to expose the bosses in the webs and provided with curved bearing faces integral with the webs and connected to the ends of the webs opposite each other, each of said bearing

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I 902

faces being separated from the head except for the integral connection through the webs and one of said bearing faces having a substantially vertical slot therein.

[27.]* 7 A piston for an internal combustion engine comprising a head portion having a depending ring flange, a skirt portion, said skirt portion comprising a pair of substantially parallel webs carried by the head portion and provided with opposed wrist pin bosses, bearing portions carried by the ends of said webs and separated from the head by air gaps, the laterally outer faces of said web portions being free from laterally overhanging edge portions of the bearing faces, one of said bearing faces being provided with a longitudinal slot disposed intermediate the end portions of said bearing face.

[28.]* 8 In a piston for an internal combustion engine, the combination of a head having a cylindrical ring flange, oppositely disposed webs integral with the flange and carrying diametrically opposite piston pin bosses, a skirt integral with said webs and cut away to expose the sides of said webs and separated from the ring flange by circumferential slits, and provided with a longitudinal slit disposed between the ends of the webs.

[29.]* 9 In a piston for an internal combustion engine, the combination of a head comprising a disc and a peripheral flange having ring grooves therein, a pair of cordal webs connected to the flange of the head by outwardly flaring extensions, oppositely disposed wrist pin bosses in the webs, and a cylindrical skirt cut away to expose the

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[*Matter enclosed in brackets struck out in copy.]

webs and integrally connected to the ends of the latter, the skirt being separated from the head between the said [fol. 2111] webs by circumferential slits and the skirt having a longitudinally extending slit disposed between the ends of the webs on one side of the piston.

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I 903

[30.]* **10** In a piston for an internal combustion engine, the combination of a piston head including a depending ring flange, oppositely disposed webs depending from the ring flange and disposed inwardly thereof, wrist pin bosses in the webs, and curved bearing means integrally connected to the webs and separated from the head by air gaps extending circumferentially of the piston between the ends of the webs, the said bearing means having a slit located between the ends of the webs and extending in a direction lengthwise of the piston.

[31.]* **11** In a piston of an internal combustion engine, the combination of a piston head having a cylindrical ring flange depending therefrom, webs integral with the flange extending convergingly inwardly of the piston from the opposite portions of the flange and then lengthwise of the piston in substantially parallel arrangement, wrist pin bosses in the webs, and a skirt joined to the ends of the webs on opposite sides of the bosses and cut away to expose substantially all of the sides of the webs, all the foregoing parts being integrally connected together, there being circumferentially extending air gaps separating the head and skirt between the webs and a slot in one side of the skirt between the ends of the webs and extending in a direction lengthwise of the piston.

[32.]* **12** In a piston for an internal combustion engine, the combination of a piston head comprising a disc with a depending peripheral ring flange, a skirt separated from the head by circumferentially extending air gaps, cordal webs integrally connected at their end to the skirt with their outer surfaces near the points of connection with the skirt diverging outwardly to merge into the outer surfaces of the skirt, wrist pin bosses integrally formed with the webs, and integral connections between the depending flange of the head and the adjacent ends of the webs, said connections extending from the flange inwardly and length-

[* Matter enclosed in brackets struck out in copy.]

wise of the piston and merging into the webs with outwardly [fol. 2112] diverging surfaces, the skirt having a longitudinally extending slit formed on one side thereof between the ends of the webs.

(Sig.)
364997—99
I 904

Respectfuly submitted,
FRANK JARDINE,
By RICHEY & WATTS,
His Attorneys.

REMARKS

The claims constituting the issues of the interferences which were decided adversely to applicant have been canceled and new claims drawn specifically to the patentable subject matter of Applicant's device substituted.

Claims 3 and 6 constituted the issue of interferences No. 49582 and 49589, in which priority was awarded to applicant.

Claims 4, 5, 6, 8, 9, and 10 were, before the declaration of the interferences, rejected as not being patentably distinct from claim 3. Accordingly the subject matter of these claims is believed to be allowable along with claim 3.

Claims 4 and 5 have been amended slightly to further distinguish from claim 3, and it is believed that all of these claims may now be allowed.

New claim 23 includes webs cast integrally with the ring flange and also recites the relation of the thrust members and webs which join at included angles sufficiently great to permit removal of a permanent mold part used in casting the piston. These limitations distinguish from the prior art and from the applications involved in the interferences. Claim 24 is believed to be patentable by reason of the recitation of a skirt portion cut away from the head to expose the bosses in combination with the other elements of applicant's structure. Claim 25 includes in addition the vertical ribs 9 above the piston pin bosses joining the webs to the head. Claim 26 defines these ribs more specifically.

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I 905

Claim 27 is believed to be patentable by reason of the definition of the webs as having lateral outer faces free from

[fol. 2113] laterally overhanging edge portions of the bearing faces.

Claim 28 is similar to claim 3 but recites in addition that the webs are integral with the ring flange. Claim 29 distinguishes from Claim 6 in the same manner. Each of these claims also defines the longitudinal slit in slightly broader terms than claims 3 and 6.

Claim 30 is drawn along the lines of Claim 11 but distinguishes from the disclosure of the parties involved in the interferences by reciting the webs as depending from the ring flange.

Claims 31 and 32 are drawn more specifically to the structure of applicant's piston which permits its manufacture in permanent molds. Claim 31 states that the webs are integral with the flange and extend convergingly inwardly therefrom and have substantially all of their outer sides exposed. Claim 32 defines the outwardly diverging connections between the webs and the skirt sections and the outwardly diverging connections between the webs and the ring flange.

All of the claims now in the case are believed to be patentably distinct from the prior art and the disclosures of the winning parties in the interferences and are believed to be sufficiently distinguished from each other to warrant their allowance.

Respectfully submitted,
By RICHEY & WATTS,
Applicant's Attorneys.

11CS 364997—101

(Chief Clerk May 8 30 U. S. Patent Office)

U. S. Patent Office
May 8 1930
Division 12, **Paper No. 53**

Applicant	Frank Jardine	
Application	Pistons	
	450,898	Division
Serial No.	[364,997]*	12
Filed	March 9, 1921	
Docket No.	1977	

[*Matter enclosed in brackets struck out in copy.]

[fol. 2114]

Washington, D. C.,
May 8, 1930.

Hon. Commissioner of Patents,
Washington, D. C.

Sir:

Kindly amend the above-entitled application as follows:
Cancel claims 2, 4, 5, 7, 8, 9 and 10.
Cancel the claim submitted in the amendment dated August 7, 1928.

Respectfully submitted,

FRANK JARDINE,
By RICHEY & WATTS,
His Attorneys.

REMARKS

At the interview courteously granted this day by the Examiner to applicant's attorney, claims 2, 4, 5, 7, 8, 9 and 10 were discussed in connection with the Office action of Oct. 5, 1922, and in connection with claims 23-32 inclusive, added by the preceding amendment.

The Examiner held claim 2 to be unpatentable over the issue of Interference No. 49590, involving applicant's claim 1. Accordingly, this claim has been cancelled.

Claims 4, 5, 7, 8, 9, and 10 have been cancelled as not being patentably distinct from Claim 3, and also because it is believed the patentable subject-matter thereof is more clearly defined in new claims 23-32, inclusive.

The claim submitted by the amendment dated Aug.

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7, 1928, which was not entered, has been cancelled in order to clarify the record.

Respectfully submitted,

By RICHEY & WATTS,
Applicant's Attorneys.

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[fol. 2115] (Mailed May 9 1930)

181

Div. 12 Serial No. 450,898
CAK:JTE (Renewal)

Address only
The Commissioner of Patents
Washington, D. C.

DEPARTMENT OF COMMERCE
UNITED STATES PATENT OFFICE

Washington May 9, 1930.

Frank Jardine (Assor etc.)

Your APPLICATION for a patent for an IMPROVEMENT in PISTONS filed Mar. 9, 1921 has been examined and ALLOWED with 12 claims.

The final fee, TWENTY DOLLARS, WITH $1 ADDITIONAL FOR EACH CLAIM ALLOWED IN EXCESS OF 20, must be paid not later than SIX MONTHS from the date of this present notice of allowance. If the final fee be not paid within that period, the patent will be withheld, but the application may be renewed within one year after the date of the original notice with a renewal fee of $20 and $1 additional for each claim in excess of 20.

The office delivers patents upon the day of their date, on which date their term begins to run. The preparation of the patent for final signing and sealing will require about four weeks, and such work will not be begun until after payment of the necessary final fee.

When the final fee is paid, there should also be sent, DISTINCTLY AND PLAINLY WRITTEN, the name of the INVENTOR, TITLE OF THE INVENTION, AND SERIAL NUMBER AS ABOVE GIVEN, DATE OF ALLOWANCE (which is the date of this circular), DATE OF FILING, and, if assigned, the NAMES OF THE ASSIGNEES.

If it is desired to have the patent issue to an ASSIGNEE OR ASSIGNEES, an assignment containing a REQUEST to that effect, together with the FEE for recording the same, must be filed in this office on or before the date of payment of the final fee.

After issue of the patent, uncertified copies of the drawings and specifications may be purchased at the price of TEN CENTS EACH. The money should accompany the order. Postage stamps will not be received.

The final fee will NOT be received from other than the applicant, his assignee or attorney, or a party in interest as shown by the records of the Patent Office.

[fol. 2116] NOTICE.—WHEN THE NUMBER OF CLAIMS ALLOWED IS IN EXCESS OF 20, NO SUM LESS THAN $20 PLUS $1 ADDITIONAL FOR EACH CLAIM IN EXCESS OF TWENTY CAN BE ACCEPTED AS THE FINAL FEE.

☞ IN REMITTING THE FINAL FEE GIVE THE SERIAL NUMBER AT THE HEAD OF THIS NOTICE.

☞ UNCERTIFIED CHECKS WILL NOT BE ACCEPTED.

Respectfully,
THOMAS E. ROBERTSON,
Commissioner of Patents.

Richey & Watts,
1983 Union Trust Bldg.,
Cleveland, Ohio.

NOTICE.

Final Fee effective June 1, 1930. $25, with $1.00 additional for each claim in excess of 20.

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($20 Rec'd May 15 30 C. C. U. S. Patent Office J)

FINAL FEE PAID TO THE COMMISSIONER OF PATENTS

(Be careful to give correct Serial No.)

Serial No. 450,898

INVENTOR:
FRANK JARDINE
PATENT TO BE ISSUED TO
AS PER RECORD (Cleveland Trust Company)
NAME OF INVENTION, AS ALLOWED:
DATE OF PAYMENT:
May 15 1930
FEE:
$20.00.
DATE OF FILING:
March 9, 1921
DATE OF CIRCULAR OF ALLOWANCE:
May 9, 1930

[fol. 2117] The Commissioner of Patents will please apply the accompanying fee as indicated above.

RICHEY & WATTS,
Attorney.

SEND PATENT TO

Messrs. Richey and Watts
Union Trust Bldg.,
Cleveland, Ohio.

Final fees will not be received from other than the applicant, his assignee or attorney, or a party in interest as shown by the records of the Patent Office.

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(Mailed May 28 1930)

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CAK:JTS
Paper No. 54

Div. 12 Room 380
Address only
"The Commissioner of Patents,
Washington, D. C."
and not any official by name

All communications respecting this application should give the serial number, date of filing, and name of the applicant

DEPARTMENT OF COMMERCE

UNITED STATES PATENT OFFICE

Washington May 28, 1930.

Please find below a communication from the EXAMINER in charge of this application.

THOMAS E. ROBERTSON,
Commissioner of Patents.

Richey & Watts,
1983 Union Trust Bldg.,
Cleveland, Ohio.

Applicant Frank Jardine
Ser. No. 450,898 (Renewal)
Filed Mar. 9, 1921
For Pistons.

In accordance with the provisions of Order No. 2308, dated March 12, 1917, which reads in part as follows:

* * * * * * *

[fols. 2118-2240] Obvious informalities in the application may be corrected by the examiner, but said correction must be in the form of an amendment, approved by the Principal Examiner in writing, placed in the file, and made a part of the record. The changes specified in the amendment will be entered by the clerk in the regular way.

* * * * * * *

the changes, hereinafter specified, are made by the examiner in the application above identified.

Should these changes not be satisfactory to the applicant, appropriate amendment may be proposed under the provisions of Rule 78, provided the specification has not been printed.

The application has been amended as follows:

I

Claim 2, line 3, "*chordal*" has been substituted for "cordal."

C. C. HENRY,
Examiner.
364997—106

* * * * * * *

[fol. 2241] **DEFENDANTS' EXHIBIT 4-X**

List of Patents Owned by The Cleveland Trust Company under Trust

(Filed January 27, 1934)

December 10, 1932.

PISTON PATENTS OWNED BY PISTON TRUST ESTATE

	Pat. No.	Issued	Ser. No.
E. O. Spillman & L. P. Mooers	1,092,870	4/14/14	779,757 (Expired)
G. E. Franquist	1,153,902	9/21/15	854,484 (Expired)
Edward O. Spillman	1,229,540	6/12/17	130,823
Victor E. Schmiedeknecht	1,256,265	2/12/18	180,511
J. G. Vincent	1,279,184	9/17/18	796,647
Howard C. Marmon	1,293,846	2/11/19	108,274
Robert B. Wasson	1,320,188	10/28/19	82,601
Harold D. Church	1,327,147	1/ 6/20	96,880
E. E. Allyne	1,329,820	2/ 3/20	115,887
J. H. Bamberg	1,329,821	2/ 3/20	106,513
F. A. Parkhurst	1,329,822	2/ 3/20	110,844

	Pat. No.	Issued	Ser. No.
F. A. Parkhurst	1,329,823	2/ 3/20	259,596
Louis P. Mooers	1,347,819	7/27/20	333,111
J. E. Diamond	1,357,851	11/ 2/20	117,894
Charles A. Marien	1,371,320	3/15/21	302,904
Edward J. Gulick	1,387,538	8/16/21	307,527
Charles A. Marien	1,388,279	8/23/21	420,360
Louis P. Mooers	1,402,308	1/ 3/22	390,623
Louis P. Mooers	1,402,309	1/ 3/22	172,380
Montague Stanley Napier	1,403,560	1/17/22	418,959
[fol. 2242]			
William Guy Berry et al	1,408,066	2/28/22	478,195
Edmund E. Allyne	1,426,138	8/15/22	270,318
F. A. Parkhurst	1,440,549	1/ 2/23	409,304
Roland M. Howdeshell	Re-12,273	2/23/26	51,529
(Original Pat.	1,473,233		383,519)
Harry J. Hater	1,485,078	2/26/24	556,234
James M. Howe	1,494,483	5/20/24	466,415
Laurence Henry Pomeroy	1,499,073	6/24/24	321,696
Montague Napier	1,525,316	2/ 3/25	419,715
William G. Berry et al	1,551,233	8/25/25	410,264
Harry J. Hater	1,563,025	11/24/25	676,344
Frank Jardine	1,563,194	11/24/25	47,213
Jardine & Jehle	1,580,491	4/13/26	466,371
Allen B. Norton	1,633,187	6/21/27	80,902
George D. Welty	1,638,898	8/16/27	39,676
Howard E. Maynard (½ Int.)	1,655,968	1/10/28	434,467
Harry J. Hater	1,656,482	1/17/28	588,473
Gustav R. Kelm	1,659,881	2/21/28	470,502
Stephen D. Hartog	1,675,174	6/26/28	53,063
James Edward Diamond	1,695,417	12/18/28	561,997
Harold J. Ness	1,699,621	1/22/29	100,496
Harold J. Ness	1,699,621	1/22/29	100,497
Frank Jardine	1,727,647	9/10/29	100,773
Frank Jardine	1,730,120	10/ 1/29	100,772
Stephen D. Hartog	1,730,885	10/ 8/29	201,169
Stephen D. Hartog	1,732,361	10/22/29	227,705
Jeffries & Archer	1,732,557	10/22/29	707,868
Frank Jardine	1,741,843	12/31/29	47,234
Wm. C. McCoy	1,757,131	5/ 6/30	234,398
Jehle & Jardine	1,758,444	5/13/30	544,487
Frank Jardine	1,759,508	5/20/30	137,194
Wm. C. McCoy	1,761,140	6/ 3/30	133,909
Wm. C. McCoy	1,761,141	6/ 3/30	143,878
Wm. C. McCoy	1,761,142	6/ 3/30	331,513
Frank Jardine	1,763,523	6/10/30	364,997
(Renewal of Ser. No.	450,898)		
Harry J. Hater	1,764,871	6/17/30	291,427
Frank J. Kent	1,768,608	7/ 1/30	201,650
Harry J. Hater	1,769,835	7/ 1/30	188,736
George D. Welty	1,775,446	9/ 9/30	128,764
Frank Jardine	1,784,291	12/ 9/30	100,771
Stephen D. Hartog	1,794,767	3/ 3/31	467,587
Wm. C. McCoy	1,802,180	4/21/31	400,476
Melbourne A. Beckmann	1,768,815	7/ 1/30	369,130
Melbourne A. Beckmann	1,768,816	7/ 1/30	369,131
Stephen D. Hartog	1,812,696	6/30/31	326,832
Edward J. Gulick	1,815,733	7/21/31	204,661
Martin B. Covert	1,818,307	8/11/31	442,989
Frank Jardine	1,819,998	8/18/31	340,088
Harry J. Hater	Re-18,178	9/ 8/31	274,321
(Original Pat. No.	1,656,482)		
William C. McCoy	1,825,750	10/ 6/31	143,879
G. E. Franquist	1,826,171	10/ 6/31	563,782
Louis P. Mooers	1,826,185	10/ 6/31	649,481

	Pat. No.	Issued	Ser. No.
William C. McCoy	1,830,519	11/ 3/31	451,655
Frank Jardine et al	1,835,874	12/ 8/31	79,651
Frank Jardine et al	1,835,875	12/ 8/31	174,202
Stephen D. Hartog	1,842,022	1/19/32	359,137
Stephen D. Hartog	1,842,023	1/19/32	611,959
Frank Jardine	1,847,947	3/ 1/32	312,429
Allen B. Norton	1,853,450	4/12/32	51,748
Gustave E. Franquist	1,872,724	8/23/32	531,962
James E. Diamond	1,874,925	8/30/32	126,110

[fol. 2243] **DEFENDANTS' EXHIBIT 4-Y**

Bill of Complaint and Answer in Case No. 27-32 in the U. S. District Court for the Southern District of New York, The Cleveland Trust Company vs. The National Piston Company, Inc.

(Filed January 27, 1934)

UNITED STATES OF AMERICA,
SOUTHERN DISTRICT OF NEW YORK, ss:

I, CHARLES WEISER, Clerk of the District Court of the United States for the Southern District of New York do hereby certify that the writings annexed to this certificate have been compared with their originals on file and remaining of record in this office; that they are correct transcripts therefrom and of the whole of the said originals.

IN TESTIMONY WHEREOF I have hereunto subscribed my name and affixed the seal of the said Court at the City of New York, in the Southern District of New York, this 27th day of January in the year of our Lord one thousand nine hundred and thirty-three and of the Independence of the United States the One Hundred and fifty-seventh.

CHARLES WEISER,
Clerk.

(Seal)

IN THE UNITED STATES DISTRICT COURT

IN AND FOR THE SOUTHERN DISTRICT OF NEW YORK

THE CLEVELAND TRUST COMPANY,
Plaintiff,

vs.

THE NATIONAL PISTON COMPANY, INCORPORATED,
Defendant.

IN EQUITY No. 27-32

BILL OF COMPLAINT.

* * * * * * *

[fol. 2244] IV.

That heretofore and before the 18th day of July, 1913, Edward O. Spillman and Louis P. Mooers, citizens of the United States, residing in the County of Niagara, State of New York, were the original, first and joint inventors of certain new and useful imrpovements in Pistons for Explosion Engines or Motors, fully described in Letters Patent of the United States No. 1,092,870, hereinafter mentioned, which invention or improvement was not known or used by [fol. 2245] others in this country, or patented or described in any printed publication in this or any foreign country, prior to their invention thereof, or more than two years prior to their application for said Letters Patent, and had not been in public use or on sale in this country for more than two years prior to said application, and had not been abandoned to the public, and not not been patented or caused to be patented by them or their legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of their application for Letters Patent of the United States therefor; that the said Edward O. Spillman and Louis P. Mooers made due application to the Commissioner of Patents of the United States in accordance with the then existing acts of Congress, for Letters Patent of the United States for said invention or improvement, and having in all respects complied with the conditions and requisitions of said acts of Congress, on the 14th day of April, 1914, Letters Patent of the United States No. 1,092,870, signed, sealed and executed in due form of law for the said invention or improvement were issued and delivered unto said Edward O. Spillman and Louis P. Mooers, whereby there was secured unto them, their successors and assigns for the term of seventeen years from the said 14th day of April, 1914, the sole and exclusive right to make, use and sell to others to be used, throughout the United States and the territories thereof the aforesaid invention or improvement, all as by said Letters Patent, or a duly authenticated copy thereof in Court to be produced and shown unto your Honors, will more fully and at large appear.

V.

That subsequent to the granting of the aforesaid Letters Patent The Herschel-Spillman Company, a corporation of the State of New York, acquired an interest in said invention and Letters Patent from the said Edward O. Spillman, and that thereafter and on or about the 16th day of June, 1916, the said Edward O. Spillman and the said The Herschel-Spillman Company, by an instrument in writing duly executed and delivered and duly recorded in the Patent Office of the United States, in Liber R-101, page 1 of the Transfers of Patents, assigned, and transferred an undivided one-half of the entire right, title and interest in and to said Letters Patent No. 1,092,870 to one George B. Pitts; [fols. 2246-2248] and that thereafter and on or about the 3rd day of July, 1919, the said George B. Pitts by an instrument in writing assigned said undivided one-half of the entire right, title and interest in, to and under said Letters Patent No. 1,092,870, to your Orator, The Cleveland Trust Company, which assignment was duly recorded on the 28th day of July, 1919, in Liber Q-107, page 336 of the Transfers of Patents; and that the said Louis P. Mooers on the 10th day of July, 1919, by an instrument in writing assigned an undivided one-half of the entire right, title and interest in, to and under said Letters Patent No. 1,092,870 to your Orator, The Cleveland Trust Company, which assignment was duly recorded on the 28th day of July, 1919, in Liber, Q-107, page 339 of the Transfers of Patents; whereby your Orator became vested with and holds the entire right, title and interest in, to and under said Letters Patent No. 1,092,870, as will more fully and at large appear upon production in Court of the assignments aforesaid.

* * * * * * *

[fol. 2249] X

That heretofore and before the 2nd day of June, 1917, Louis P. Mooers, a citizen of the United States, residing at Cincinnati, Hamilton County, State of Ohio, was the original, first and true inventor of certain new and useful improvements in Pistons for Internal Combustion Motors, fully described in Letters Patent of the United States No. 1,402,309, hereinafter mentioned, which invention or improvement was not known or used by others in this country,

or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his application for said Letters Patent, had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public, and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States, therefor; that the said Louis P. Mooers made due application to the Commissioner of Patents of the United States in accordance with the then existing acts of Congress, for Letters Patent of the United States for said invention and improvement and by an instrument in writing duly executed and delivered by him and duly recorded in the Patent Office of the United States in Liber P-103 page 133 of the Transfers of Patents, assigned an undivided one half of the entire right, title and interest in and to said invention and improvement and in and to said application for Letters Patent to George B. Pitts of Cleveland, Ohio, and au- [fol. 2250] thorized and requested the Commissioner of Patents to issue the Letters Patent upon said application and for said invention and improvement to said George B. Pitts and Louis P. Mooers; and thereafter, by instruments in writing duly executed and delivered and duly recorded in the Patent Office of the United States, the said George B. Pitts and Louis P. Mooers assigned and transferred unto your Orator, The Cleveland Trust Company, the entire right, title and interest in and to said invention and application for Letters Patent, and authorized and requested the Commissioner of Patents to issue the Letters Patent upon said application and for said invention to said The Cleveland Trust Company, pursuant to which said assignment the aforesaid Letters Patent No. 1,402,309, signed, sealed and executed in due form of law, for the said invention and improvement, were issued and delivered unto your Orator, The Cleveland Trust Company, on the 3rd day of January, 1922, whereby there was secured unto your Orator and its successors and assigns, for the term of seventeen years from the said 3rd day of January, 1922, the sole and exclusive right to make, use and sell to others to be used, throughout the United States and the territories thereof,

the aforesaid invention and improvement, all as by said Letters Patent or a duly authenticated copy thereof, in court to be produced and shown unto your Honors, will more fully and at large appear.

XI

And your Orator further avers and shows unto your Honors that the said defendant, The National Piston Company, Incorporated, as your Orator is informed and believes, having due and timely notice of said Letters Patent of the United States, and each of them, and well knowing the premises and the exclusive rights and privileges as aforesaid secured to your Orator by the said Letters Patent, but contriving and planning to injure your Orator and deprive it of the profits, benefits and advantages which would have otherwise accrued to your Orator from the said Letters Patent, has been since the grant of each of the Letters Patent aforesaid, and still is in the said Southern District of New York, unlawfully, wrongfully, and without license or permission of your Orator, manufacturing or causing to be manufactured, using and selling Pistons constructed according to and containing the aforesaid inventions, discoveries or improvements patented by said Letters Patent in [fol. 2251] violation and infringement of the aforesaid exclusive rights and privileges of your Orator, and has threatened to continue such infringing acts by making, using and selling Pistons in violation and infringement of your Orator's exclusive rights and privileges under said Letters Patent and to your Orator's great and irreparable loss and damage and contrary to equity and good conscience and to the manifest injury of your Orator in the premises.

* * * * * * *

[fols. 2252-2258] THE CLEVELAND TRUST COMPANY,
By F. H. HOBSON,
Vice-President.

Attest:
A. J. PERFLER,
Ass't Trust Officer.
ROUNDS, SCHURMAN & DWIGHT,
Solicitors for Complainant.
EDWARD RECTOR,
Of Counsel.

* * * * * * *

[fol. 2259] IN THE UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

In Equity No. 27-32

THE CLEVELAND TRUST COMPANY

vs.

THE NATIONAL PISTON COMPANY, INC.

Final Decree

This cause having come on to be heard at this term upon the consent of the parties to the entry of this decree and thereupon in consideration thereof, it is ordered, adjudged and decreed as follows:

First: That Letters Patent to Edward O. Spillman and Louis P. Mooers, No. 1,092,870, April 14th, 1914 for Pistons for Explosion Engines or Motors is good and valid in law;

Second: That the said Edward O. Spillman and Louis P. Mooers are the true and original inventors of the invention and improvements described and claimed in said Letters Patent;

Third: That Letters Patent to Jesse G. Vincent No. 1,279,184, Sept. 17, 1918, for Pistons is good and valid in law;

Fourth: That the said Jesse G. Vincent is the true and original inventor of the inventions and improvements described in said Letters Patent;

Fifth: That Letters Patent to Harold D. Church, No. 1,327,147, Jan. 6th, 1920, for Hydro-Carbon Motor is good and valid in law;

Sixth: That the said Harold D. Church is the true and original inventor of the inventions and improvements described in said Letters Patent;

Seventh: That Letters Patent to Louis P. Mooers, No. 1,402,309, Jan. 3rd, 1922, for Pistons for Internal Combustion Motors is good and valid in law;

Eighth: That the said Louis P. Mooers is the true and original inventor of the inventions and improvements described in said Letters Patent;

[fol. 2260] Ninth: That the said The Cleveland Trust Company, the Plaintiff, is the lawful owner of said patents and each of them;

Tenth: That the Defendant has infringed upon the said Letters Patent, and each of them, and upon the exclusive rights of the Plaintiff under the same by the manufacture, use and sale of Pistons.

Eleventh: Accounting having been waived, no accounting is ordered.

Twelfth: That a perpetual injunction issue out of and under the seal of this court directed to the said Defendant, its associates, directors, officers, attorneys, clerks, agents, servants, workmen and others employed enjoining and restricting them and each of them, from directly or indirectly making or causing to be made, using or causing to be used or vending to others to be used in any manner, any article, device, apparatus or piston containing, embodying or employing the said inventions or improvements, or any of them covered by the said Letters Patent, or of any piston capable of or adapted to be used in infringement of said patents, or either of them, or from infringing upon or violating the said Letters Patent or either of them in any way whatsoever without the license of the owner or owners present or future of said patents.

Thirteenth: No costs are taxed.

Fourteenth: The parties having waived appeal, no petition for appeal will be entertained and no order for appeal will be allowed.

F. A. Winslow, United States District Judge.

We consent to the entry of the above decree.

Edward R. Alexander, Counsel for Plaintiff. Gifford & Scull, counsel for defendant.

[fol. 2261] **DEFENDANTS' EXHIBIT 4-Z**

Bill of Complaint in Case No. 535 in the United States District Court for the Eastern District of Michigan, The Cleveland Trust Company vs. E. C. Long Piston Company and E. C. Long.

(Filed January 27, 1934)

IN THE UNITED STATES DISTRICT COURT IN AND FOR THE EASTERN DISTRICT OF MICHIGAN

In Equity. No. 535

THE CLEVELAND TRUST COMPANY, Plaintiff

vs.

E. C. LONG PISTON COMPANY AND E. C. LONG, Defendants

BILL OF COMPLAINT

To the Honorable Judges of the United States District Court for the Eastern District of Michigan:

The Cleveland Trust Company, a corporation organized and exising under and by virtue of the laws of the State of Ohio, and having its principal office and place of business at Cleveland in said State, brings this bill of complaint against E. C. Long Piston Company, a corporation organized and existing under and by virtue of the laws of the State of Michigan, and E. C. Long, a resident of Detroit, Michigan and a citizen of said State, both having a regular, established and joint place of business at Detroit in the State of Michigan, within the aforesaid Eastern District of Michigan, and thereupon your Orator complains and says:

I

That your Orator, The Cleveland Trust Company, is a corporation duly organized and existing under and by virtue of the laws of the State of Ohio, and has its principal office and place of business in Cleveland in said State.

II

That the defendant, E. C. Long Piston Company, is a corporation duly organized and existing under and by virtue [fol. 2262] of the laws of the State of Michigan, and the defendant, E. C. Long, is a resident and citizen of the State of Michigan, and both have a regular, established and joint place of business and principal office at Detroit in the State of Michigan, within the aforesaid Eastern Judicial District of Michigan, where they, and each of them, have committed the acts of infringement hereinafter set forth.

III

That the jurisdiction of the Court in this cause is based upon the fact that the suit is one touching patent rights, and is brought to restrain infringement of certain Letters Patent owned by the plaintiff, and for an accounting of profits and damages arising from past infringement of said Letters Patent by the defendants.

IV

That heretofore and before the 18th day of July, 1913, Edward O. Spillman and Louis P. Mooers, citizens of the United States, residing in the County of Niagara, State of New York, were the original, first and joint inventors of certain new and useful improvements in Pistons for Explosion Engines or Motors, fully described in Letters Patent of the United States No. 1,092,870, hereinafter mentioned, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country, prior to their invention thereof, or more than two years prior to their application for said Letters Patent, and had not been in public use or on sale in this country for more than two years prior to said application, and had not been abandoned to the public, and had not been patented or caused to be patented by them or their legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of their applications for Letters Patent of the United States therefor; that the said Edward O. Spillman and Louis P. Mooers made due application to the Commissioner of Patents of the United States in accordance with the then exist-

ing acts of Congress, for Letters Patent of the United States for said invention or improvement, and having in all respects complied with the conditions and requisitions of said acts of Congress, on the 14th day of April, 1914, Letters Patent of the United States No. 1,092,870, signed, [fol. 2263] sealed and executed in due form of law, for the said invention or improvement were issued and delivered upto said Edward O. Spillman and Louis P. Mooers, whereby there was secured unto them, their successors and assigns for the term of seventeen years from the said 14th day of April, 1914, the sole and exclusive right to make, use and sell to others to be used, throughout the United States and the territories thereof the aforesaid invention or improvement, all as by said Letters Patent, or a duly authenticated copy thereof in Court to be produced and shown unto your Honor, will more fully and at large appear.

V

That subsequent to the granting of the aforesaid Letters Patent, namely, on or about the 16th day of June, 1916, by an instrument in writing, one George B. Pitts acquired from said Edward O. Spillman and The Herschel Spillman Company, a corporation of the State of New York, the undivided one half of the entire right and interest in, to and under said Letters Patent of the United States No. 1,092,870, said assignment having been duly recorded on the 5th day of September, 1916 in Liber R-101, page 1 of the Transfers of Patents; that thereafter and on or about the 3rd day of July, 1919 the said George B. Pitts by an instrument in writing assigned said undivided one half of the entire right, title and interest in, to and under said Letters Patent No. 1,092,870, to your Orator, The Cleveland Trust Company, which assignment was duly recorded on the 28th day of July, 1919 in Liber Q-107, page 336 of the Transfers of Patents; and that the said Louis P. Mooers on the 10th day of July, 1919, by an instrument in writing assigned the undivided one half of the entire right, title and interest in, to and under said Letters Patent No. 1,092,870 to your Orator, The Cleveland Trust Company, which assignment was duly recorded on the 28th day of July, 1919, in Liber Q-107, page 339 of the Transfers of Patents; whereby your Orator became vested with and holds the entire right, title and interest in, to and under

said Letters Patent No. 1,092,870, as will more fully and at large appear upon production in Court of the assignments aforesaid.

[fol. 2264] VI

That heretofore and before the 22nd day of October, 1913, Jesse G. Vincent, a citizen of the United States, and resident of Detroit, Wayne County, State of Michigan, was the original, first and true inventor of certain new and useful improvements in Pistons, fully described in Letters Patent of the United States No. 1,279,184, hereinafter mentioned, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his application for said Letters Patent; had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public, and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States therefor; that the said Jesse G. Vincent made due application to the Commissioner of Patents of the United States in acordance with the then existing acts of Congress, for Letters Patent of the United States for said invention and improvement, and by an instrument in writing duly executed and delivered by him, and duly recorded in the Patent Office of the United States, assigned and transferred the entire right, title and interest in and to said invention and improvement and in and to said application for Letters Patent, to Packard Motor Car Company, a corporation organized and existing under the laws of the State of Michigan, and authorized and requested the Commissioner of Patents to issue the Letters Patent upon said application and for the said invention and improvement to the said Packard Motor Car Company, and having in all respects complied with the conditions and requisitions of said acts of Congress, on the 17th day of September, 1918, Letters Patent of the United States No. 1,279,184, signed, sealed and executed in due form of law for the said invention and improvement were issued and delivered unto said Packard Motor Car Company, as assignee of the said Jesse G. Vincent, whereby there was

secured unto said Packard Motor Car Company, and its successors and assigns for the term of seventeen years from the said 17th day of September, 1918, the sole and exclusive right to make, use and vend to others to be used, throughout the United States and the territories [fol. 2265] thereof, the aforesaid invention and improvement; all as by said Letters Patent, or a duly authenticated copy thereof in Court to be produced and shown unto your Honors, will more fully and at large appear.

VII

That subsequent to the granting of the aforesaid Letters Patent, namely on or about the 11th day of September, 1922, by an instrument in writing said Packard Motor Car Company assigned the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,279,184 to your Orator, The Cleveland Trust Company, which assignment was duly recorded on the 18th day of September, 1922, in Liber W-117 page 44 of the Transfers of Patents; whereby your Orator became vested with and holds the entire right, title and interest in, to and under said Letters Patent No. 1,279,184; as will more fully and at large appear upon production in Court of the assignment aforesaid.

VIII

That heretofore and before the 11th day of May, 1916, Harold D. Church, a citizen of the United States and a resident of Detroit, Wayne County, State of Michigan, was the original, first and true inventor of certain new and useful improvements in Hydro-Carbon Motor, fully described in Letters Patent of the United States No. 1,327,147, hereinafter mentioned, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his application for said Letters Patent, and had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public; and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent in the United States therefor; that

the said Harold D. Church made due application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress, for Letters Patent of the United States for said invention and improvement, and by an instrument in writing duly executed and de- [fol. 2266] livered by him, and duly recorded in the Patent Office of the United States, assigned and transferred the entire right, title and interest in and to said invention and improvement and in and to said application for Letters Patent to Packard Motor Car Company, a corporation organized and existing under the laws of the State of Michigan, and authorized and requested the Commissioner of Patents to issue the Letters Patent upon said application and for said invention and improvement to the said Packard Motor Car Company, and having in all respects complied with the conditions and requisitions of said Acts of Congress, on the 6th day of January, 1920 Letters Patent of the United States No. 1,327,147, signed, sealed and executed in due form of law for the said invention and improvement were issued and delivered unto said Packard Motor Car Company, as assignee of said Harold D. Church, whereby there was secured unto said Packard Motor Car Company and its successors and assigns for the term of seventeen years from the 6th day of January, 1920, the sole and exclusive right to make, use and vend to others to use throughout the United States and the territories thereof, the aforesaid invention and improvement; all as by said Letters Patent, or a duly authenticated copy thereof in Court to be produced and shown unto your Honors will more fully and at large appear.

IX

That subsequent to the granting of the aforesaid Letters Patent, namely on or about the 11th day of September, 1922, by an instrument in writing, said Packard Motor Car Company assigned the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,327,147 to your Orator, The Cleveland Trust Company, which assignment was duly recorded on the 18th day of September, 1922, in Liber C-117 page 64 of the Transfers of Patents; whereby your Orator became vested with and holds the entire right, title and interest in, to and under said Letters Patent No. 1,327,147, as will more fully and at

large appear upon production in Court of the assignment aforesaid.

X

That heretofore and before the 2nd day of June, 1917, Louis P. Mooers, a citizen of the United States, residing at Cincinnati, Hamilton County, State of Ohio, was the [fol. 2267] original, first and true inventor of certain new and useful improvements in Pistons for Internal Combustion Motors, fully described in Letters Patent of the United States No. 1,402,309, hereinafter mentioned, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his application for said Letters Patent; had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public, and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States therefor; that the said Louis P. Mooers made due application to the Commissioner of Patents of the United States in accordance with the then existing acts of Congress, for Letters Patent of the United States for said invention and improvement and by an instrument in writing duly executed and delivered by him and duly recorded in the Patent Office of the United States in Liber P-103, page 133 of the Transfers of Patent, assigned and undivided half of the entire right, title and interest in, and to said invention and improvement and in and to said application for Letters Patent to George B. Pitts of Cleveland, Ohio, and authorized and requested the Commissioner of Patents to issue the Letters Patent upon said application and for said invention and improvement to said George B. Pitts and Louis P. Mooers; and by said instruments in writing specified in Article V of this bill as recorded in Liber Q-107, pages 338 and 339 of the Transfer of Patents, said George B. Pitts and Louis P. Mooers, respectively, each assigned an undivided one-half of the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,402,309 to your Orator, The Cleveland Trust Company, and authorized and requested the

Commissioner of Patents to issue the Letters Patent upon said application and for said invention and improvement to said The Cleveland Trust Company, whereby your Orator became vested with and holds the entire right, title and interest in, to and under said Letters Patent No. 1,402,309, as will more fully and at large appear upon production in Court of the said Letters Patent and the assignments aforesaid.

[fol. 2268] XI

And your Orator further avers and shows unto your Honors that the said defendants, E. C. Long Piston Company and E. C. Long, as your Orator is informed and believes, having due and timely notice of said Letters Patent of the United States, and each of them, and well knowing the premises and the exclusive rights and privileges as aforesaid secured to your Orator by the said Letters Patent, but contriving and planning to injure your Orator and deprive it of the profits, benefits, and advantages which would have otherwise accrued to your Orator from the said Letters Patent have been since the grant of each of the Letters Patent aforesaid, and still are in the said Eastern District of Michigan, unlawfully, wrongfully, and without license or permission of your Orator, manufacturing, or causing to be manufactured, using and selling Pistons constructed according to and containing the aforesaid inventions, discoveries or improvements patented by said Letters Patent in violation and infringement of the aforesaid exclusive rights and privileges of your Orator, and have threatened to continue such infringing acts by making, using and selling Pistons in violation and infringement of your Orator's exclusive rights and privileges under said Letters Patent and to your Orator's great and irreparable loss and damage and contrary to equity and good conscience and to the manifest injury of your Orator in the premises.

XII

That your Orator has caused notice to be given to the defendants, and each of them, of this aforesaid infringement of said Letters Patent, and each of them, and of the rights of your Orator in the premises, and requested the defendants, and each of them, to desist from such infringement; but that they and each of them have disregarded

said notice and request and are continuing such infringement of said Letters Patent as aforesaid;

And forasmuch as your Orator can have no adequate relief except in this Court, and to the end therefor that the defendants may, if they can, show cause why your Orator should not have the relief hereinafter prayed, and may make full disclosure of all the matters aforesaid, your Orator prays

1. That the said defendants, E. C. Long Piston Company and E. C. Long, may be required to appear and make full, true, direct and perfect answer to the matters heretofore [fol. 2269] stated and charged, but not under oath, answer under oath being hereby expressly waived.

2. That the said defendants, E. C. Long Piston Company and E. C. Long, may be compelled to account for and pay over to your Orator the gains and profits which they, and each of them, have made and received, or shall have made and received, from said violation of your Orator's rights and from said infringement of the aforesaid Letters Patent, and each of them, and that your Honors may assess or cause to be assessed under your direction, in addition to the gains and profits to be accounted for by the defendants, the damages your Orator has sustained by reason of said infringement, and that your Honors may increase the actual damages to a sum equal to three times the amount of said assessment under the circumstances of the willful and unjust infringement of your Orator's Letters Patent by the said defendants as aforesaid.

3. That your Honors may grant unto your Orator a preliminary and also a perpetual writ of injunction, issuing out of and under the seal of this Honorable Court, and directed to the said E. C. Long Piston Company and E. C. Long, and enjoining it and him, and its and his officers, agents, servants, attorneys and workmen, and each of them, from making, using or vending or causing to be made, used or vended, or in any wise counterfeiting or imitating the inventions and improvements described and claimed in the aforesaid Letters Patent, or any part thereof, and from making, using or vending to others to be used, or causing to be made, used or vended to others to be used, any Pistons, or any parts thereof, made in accordance with said Letters Patent, or any part thereof, or like or similar to Pistons

and parts thereof which the defendant has heretofore made and vended to others in violation of the rights of your Orator as aforesaid, and from and in any manner infringing said Letters Patent, or any of them, and that the Pistons and parts thereof embodying said patented inventions and improvements, or any part thereof, now in possession of the defendants, or either of them or their agents or representatives, may be destroyed or delivered up to your Orator for that purpose.

4. That the said defendants, E. C. Long Piston Company and E. C. Long, may be decreed to pay the costs of this suit, and that your Orator may have such other and further relief as the equity of the case may require and to your Honors may seem meet.

[fol. 2270] And may it please your Honors to grant unto your Orator a writ of injunction conformable to the prayer of this bill, and also a writ of subpoena of the United States of America, directed to the said E. C. Long Piston Company and E. C. Long, commanding it and him, respectively, to appear and make answer unto this bill of complaint and to abide and conform to such order and decree in the premises as to the Court shall seem meet and be required by the principles of equity and good conscience.

And your Orator will ever pray.

THE CLEVELAND TRUST COMPANY,
By R. A. MALM,
Vice President.

ATTEST:—
A. J. PERFLER,
Asst. Trust Officer.
Solicitor for Complainant.

R. T. SAWYER,
Of Counsel.

STATE OF OHIO,
COUNTY OF CUYAHOGA, ss.

On this 6th day of April, 1923, before the undersigned a Notary Public within and for the County and State aforesaid, personally appeared R. A. MALM and made oath that he

is the Vice President of The Cleveland Trust Company, the above named complainant, that he has read the foregoing Bill of Complaint, and knows the contents thereof and that the same is true, except as to those matters stated on information and belief, and as to those matters he believes it to be true.

(Notarial Seal) .....

Notary Public.

(Here follows 1 photolithograph, side folios 2271-2278)

864A

FILED
JAN 27 1934
O'Brien M.
F. J. DENZLER Clerk
U. S. District Court N. D. O.

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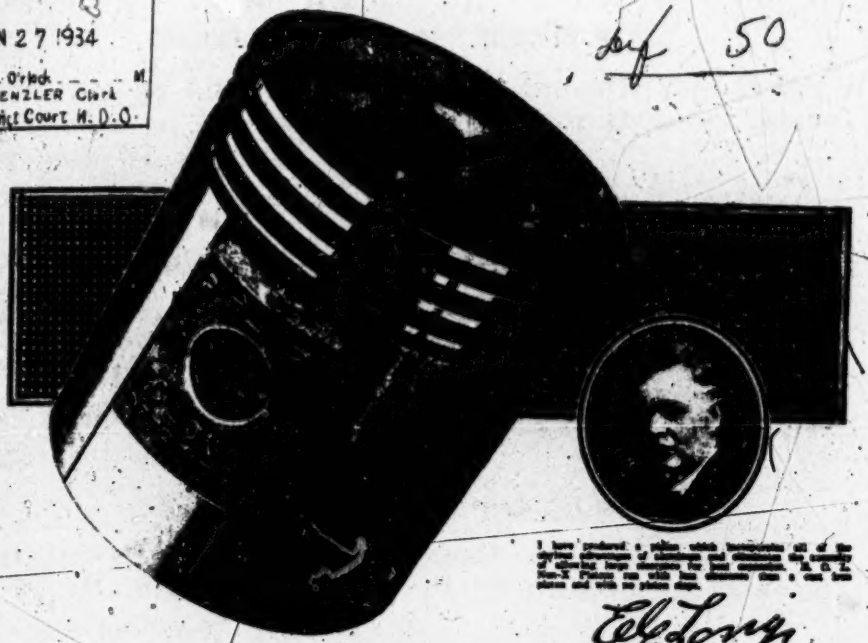

I have produced a piston which incorporates all of the various advantages of aluminum and eliminates all examples of offering here obtained by last automobile. E. C. L. Non-X Pistons are built less clearance than a cast iron piston and with no piston slap.

Ed Long

Runs With Less Clearance Than Cast Iron Pistons—

—with no slaps

MANY of America's foremost car manufacturers have adopted E. C. L. non-expanding aluminum alloy pistons as regular equipment because they run with less clearance than cast iron pistons and consequently reduce the amount of "Slap" and noise about the motor.

E. C. L. Non-X Pistons greatly reduce the consumption of gas and oil and increase the power and speed of the motor. They run cooler, reduce vibration and wear on bearings and lessen spark knocks.

E. C. L. Non-X Pistons are especially die-cast from light-weight Aluminum Alloy. They may be fitted quickly and easily to any motor—with but very little clearance. The piston is designed with slots which permit room for heat expansion in the lower part of the piston. The piston lands are machined slightly smaller than the skirt of the piston to take care of the excessive expansion in the head, which does not interfere with the running fit of the skirt. This insures a perfect fit at all times.

Install a set of E. C. L. Non-X Pistons in your next overhaul job and note how smoothly the motor runs—how quietly—and economically. Note the reduction in vibration and the elimination of the so-called "piston slap." Start the motor, cold and see how noiselessly it runs and how quickly it accelerates. These are all factors which will appeal to every motorist—especially those who are driving last year's cars or the year before. And you can capitalize this factor to your lasting profit—

E. C. L. Non-X Pistons are carried in stock for standard and oversizes for practically all makes of motors.

We will gladly tell you more about the profit-making opportunities with E. C. L. Non-X Pistons. Write us at once for complete information.

E. C. LONG
MAIN OFFICE AND FACTORY
4834 Beaubien Street, Detroit, Mich.

E-C-L Pistons

ON EXPANDING

DEFENDANTS' EXHIBIT 5-C.
Page 250 of "Motor World" for December 28, 1933.
(Filed January 27, 1934.) 172/

2271-2278

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[fol. 2279] **DEFENDANTS' EXHIBITS 5-H$_1$ to 5-H$_3$.**

Digest of Defendants' Exhibit 5-H$_1$.

(Decision of Law Examiner in the United States Patent Office, dated May 23, 1921, in Hartog v. Pomeroy Interference No. 45,351.)

Decision denies Motion to Dissolve brought by Pomeroy.

Digest of Defendants' Exhibit 5-H$_2$.

(Decision of Examiner of Interferences in the United States Patent Office, dated February 17, 1922, in Hartog v. Pomeroy Interference No. 45,351.)

Decision awards priority of invention of the subject matter in issue to Pomeroy.

Digest of Defendants' Exhibit 5-H$_3$.

(Decision of the Board of Appeals in the United States Patent Office, dated August 10, 1922, Hartog v. Pomeroy Interference No. 45,351.)

This decision reverses the decision of the Examiner of Interferences on the question of priority and awards priority of invention to Hartog.

[fol. 2280] **DEFENDANTS' EXHIBIT 5-I**

Digest of Defendants' Exhibit 5-I

(Includes Items from Exhibits Identified as V-1, V-2 and V-4)

EXHIBIT V-1—CASH DISBURSEMENTS

1919			
November	10—	Walker M. Levitt Co.	$164.03
November	19—	Walker M. Levitt Co.	67.50
November	28—	Walker M. Levitt Co.	316.33
December	6—	Walker M. Levitt Co.	243.13
December	6—	E. C. Long—Royalties for sale pistons	27.40
December	8—	Walker M. Levitt Co.	31.56
December	12—	Walker M. Levitt Co.	76.61
December	18—	E. C. Long—for moneys received on F. Motor Car Co., Chic.	720.07

1920			
January	6—	E. C. Long—Royalties	$24.00
January	10—	Walker M. Levitt Co.	57.04
January	15—	Walker M. Levitt Co.	80.33
January	19—	E. C. Long	49.92
January	22—	E. C. Long	99.49
January	22—	Walker M. Levitt Co.	108.00
January	27—	Walker M. Levitt Co.	101.25
January	29—	Walker M. Levitt Co.	149.51
February	5—	Walker M. Levitt Co.	206.38
February	5—	Walker M. Levitt Co.	199.80
February	7—	E. C. Long—Royalty	80.60
February	9—	Walker M. Levitt Co.	249.42
March	3—	E. C. Long—Royalty	127.80
March	4—	Walker M. Levitt Co.	319.28
March	6—	Walker M. Levitt Co.	668.99
April	9—	E. C. Long	157.60
May	10—	E. C. Long—Royalty	106.40
June	8—	E. C. Long—Royalties	138.40
July	8—	E. C. Long	117.80
August	2—	Walker M. Levitt Co.	1036.13
August	7—	E. C. Long	96.40
Sept.	10—	E. C. Long	151.60
Oct.	8—	Walker M. Levitt Co.	136.54
Oct.	9—	E. C. Long	87.20
October	11—	Walker M. Levitt Co.	100.58
Nov.	10—	E. C. Long	103.40
Dec.	2—	Walker M. Levitt Co.	273.38
Dec.	10—	E. C. Long	69.20

[fol. 2281]

1921			
January	10—	E. C. Long	$71.80

DEFENDANTS' EXHIBIT V-2—SALES—PISTONS

1919			
November	29—	Sales during November	1006.95
December	26—	6 Pistons returned from Franklin Sales Co., Streator, Ill.	44.10
December	26—	32 Pistons returned from Franklin Motor Car Co., Chicago, Ill.	249.90
December	26—	6 Pistons returned from Franklin Motor Car Co., Chicago	44.10

1919—Continued

December	31—	6 Pistons returned from Dixie Motor Sales Co., Memphis, Tenn.	44.10
December	31—	Sales during December	1381.80
1920			
January	31—	Sales during January	2274.00
January	31—	6 Pistons returned from Franklin Ross Motor Car Co., St. Louis	44.10
February	28—	Sales during February	4021.65
March	31—	Sales returned during March	88.20
March	31—	Sales returned from Billings, Mont.	7.35
March	31—	Sales Pistons March	4533.42
April	1—	Returned from Franklin Motor Car Co., Chicago	44.10
April	5—	Returned from Franklin Motor Car Co., Chicago	31.50
April	10—	Returned from Holmes, Canton, Ohio	172.12
April	10—	Returned from Holmes, Canton, Ohio	137.70
April	10—	Returned from Holmes, Canton, Ohio	309.83
April	19—	Returned from Norman Gratz, Canton, Ohio	12.60
April	20—	Returned from Franklin Motor Car Co., Chicago	37.80
April	30—	Sales—April	3991.48
May	31—	2 Pistons returned from Franklin Motor Car Co., Chicago	12.60
[fol. 2282]			
May	31—	1 Piston returned from Dreschler, Oak Park	$7.65
		3 Pistons returned from Franklin Motor Car Co., Chi.	18.90
May	31—	Sales—May	4071.71
June	3—	6 Pistons to be done over—returned from Horton, Kansas	37.80
June	7—	96 Pistons to be done over—returned from Holmes, Canton	550.80

1920—Continued

June	25—	22 Pistons returned to be done over for Holmes, Canton, O.	126.23
June	23—	24 Pistons returned to be done over for Holmes, Canton, O.	137.70
June	30—	6 Pistons returned from Horton, Kansas	37.80
June	30—	Sales—June	4814.88
July	1—	1 Piston from Holmes, St. Paul	8.10
July	6—	1 Piston from F. M. Car Co., Chicago, Ill.	6.30
July	9—	1 Piston from Franklin Sherwood Company	6.30
July	3—	6 Pistons from South Side Garage	37.80
July	27—	2 Pistons from Franklin Motor Car Co., Chicago	12.60
July	31—	6 Pistons from F. B. Heathman & Company	37.80
July	31—	1 Piston from Chappel Bros.	7.50
July	31—	Sales Pistons Sales Book July	3566.69
August	31—	Return Sales—Pistons	86.40
August	31—	Return Sales—Pistons	101.70
August	31—	Sales Pistons	3497.04
September	30—	Sales Pistons—September Summary	3037.05
October	30—	Sales Book Summary—Oct.	2608.26
November	30—	Sales Book Summary	2210.68
December	31—	6 Pistons returned from Wilson M. S. Co.	37.80
December	31—	2 Pistons returned from E. T. Byram	11.20
December	31—	14 Pistons returned from Franklin Motor Car Co., Chicago, Ill.	78.40
December	31—	Sales Book Summary—December	2094.09

[fol. 2283]

1921

January	31—	Return Sales, Barr & B Garage, Salina, Kansas	$37.80
January	31—	Sales Book Summary	2713.91
February	11—	Return Sales Cramer Motor Car Co.	40.00

1921—Continued

February	28—	Sales Book Summary	1603.58
March	31—	Sales Book Summary	2999.92
April	30—	Sales Book Summary	3397.89
April	22—	Return Sales W. I. Elliott Co.	5.55
May	31—	Sales Book Summary	2232.90
June	30—	Sales Book Summary	2131.38
July	30—	Sales Book Summary	1789.62

DEFENDANTS' EXHIBIT V-2—ACCOUNT NO. 44—COST OF PISTONS SOLD

1919

November	30—	Finished Pistons, 137 Sold in Nov.	422.77
December	31—	Finished Pistons Sold (184) Dec.	300.48

1920

March	31—	Pistons returned from Little Rock	88.20
March	31—	Pistons returned from Fkln. Ross M. Co., St. Louis	18.96
March	31—	Pistons returned Billings, Mont.	2.51
April	1—	Pistons returned	867.42
April	20—	" "	42.66
May	31—	2 Pistons returned F. M. Car Co., Chi.	10.52
May	31—	1 Piston returned Deschler, Oak Park, Ill.	5.26
May	31—	3 Pistons returned F. M. Car Co., Chicago	15.78

DEFENDANTS' EXHIBIT V-4—ENTRY BOOK CONSISTING OF SALES, COSTS, FACTORY EXPENSE, ET CETERA

Note on Flyleaf—"Started new system Piston Manufacture August 17, 1920—Had men come to office for a short meeting—so as to give them better understanding of our method"

[fol. 2284]

1919			
December	26—	Sales Pistons Franklin Sales Co., Streator, Ill.	$ 44.10
December	26—	Sales Pistons	24.99
		Sales Pistons, Franklin Motor Car Company, Chicago	44.10
December	31—	Sales Pistons, Dixie Motor Sales Co.	44.10
December	31—	E. C. Long, Chas. Bartlett, For Pistons	9.80
1920			
January	23—	Advertising, E. C. Long, Giving Mr. Long Cost price on Pistons used in Mr. Chas. Bartlett's car	52.56
January	22—	E. C. Long, Finished Goods	53.13

[fol. 2285] **DEFENDANTS' EXHIBIT**

Bill of Complaint in Case No. 3510 in the U. S. District Court for the Northern District of Ohio, The Cleveland Trust Company and Chrysler Corporation vs. The Simmons Mfg. Co. and Sterling Products Corp.

(Filed in District Court.)

IN THE UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF OHIO
EASTERN DIVISION

THE CLEVELAND TRUST COMPANY,
CHRYSLER CORPORATION,
Plaintiffs,

vs.

THE SIMMONS MANUFACTURING COMPANY,
STERLING PRODUCTS CORPORATION,
Defendants.

(In Equity No. 3510.)

Spillman-Mooers	1,092,870
Mooers	1,402,309
Franquist	1,153,902
Schmiedeknecht	1,256,265
Howdeshell	16,273
Maynard	1,655,968
Jardine	1,763,523
Gulick	1,815,773

AMENDED BILL OF COMPLAINT

Now come the Plaintiffs and, pursuant to the Order of this Court hereto annexed, file this amended Bill of Complaint. Plaintiffs allege:

1. That Plaintiff, The Cleveland Trust Company, is a corporation organized and existing under the laws of the State of Ohio, having its principal place of business at Cleveland, State of Ohio.

That Plaintiff, Chrysler Corporation, is a corporation organized and existing under the laws of the State of Delaware, having its principal place of business at Highland Park, State of Michigan.

2.

That Defendant, The Simmons Manufacturing Company of Cleveland, Ohio, is a corporation organized and existing under the laws of the State of Ohio and is a citizen and inhabitant thereof, having a regular and established place of business at 3506 Perkins Avenue in the City of Cleveland, County of Cuyahoga and State of Ohio.

[fol. 2286] That Defendant, Sterling Products Corporation of St. Louis, Missouri, is a corporation duly organized and existing under the laws of the State of Missouri and has a regular and established place of business at 2914 North Market Street in the City of St. Louis, County of St. Louis, and State of Missouri.

3.

This suit is brought under the patent laws of the United States, and seeks injunctive and other relief against the defendants and each of them for infringements and contributory infringements committed by each and both defendants within this Judicial District and elsewhere within the United States.

4.

That heretofore and prior to the 18th day of July, 1913, Edward O. Spillman and Louis P. Mooers, citizens of the United States, then residing at North Tonawanda in the County of Niagara and State of New York, were the original, first and joint inventors of certain new and useful improvements in Pistons for Explosion Engines or Motors,

fully described in Letters Patent of the United States, No. 1,092,870 hereinafter mentioned, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country, prior to their invention thereof, or more than two years prior to their application for said Letters Patent, and has not been in public use or on sale in this country for more than two years prior to said application, and had not been abandoned to the public, and had not been patented or caused to be patented by them or their legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of their application for Letters Patent of the United States therefor; that the said Edward O. Spillman and Louis P. Mooers made due application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress, for Letters Patent of the United States for said invention or improvement, and having in all respects complied with the conditions and requirements of said Acts of Congress, on the 14th day of April, 1914, Letters Patent of the United States No. 1,092,870, signed, sealed and executed in due form of law, for the said inven- [fol. 2287] tion or improvement were issued and delivered unto said Edward O. Spillman and Louis P. Mooers, whereby there was secured unto them, their successors and assigns for the term of seventeen years from the said 14th day of April, 1914, the sole and exclusive right to make, use and sell to others to be used, through the United States and the territories thereof, the aforesaid invention or improvement, all as by said Letters Patent, or a duly authenticated copy thereof in Court to be produced and shown unto Your Honors, will more fully and at large appear.

5

That subsequent to the granting of the aforesaid Letters Patent, namely, on or about the 16th day of June, 1916, by an instrument in writing, one George B. Pitts acquired from said Edward O. Spillman and The Herschel Spillman Company, a corporation of the State of New York, the undivided one-half of the entire right and interest in, to and under said Letters Patent of the United States No. 1,092,870, said assignment having been duly recorded on the 5th day of September, 1916, in Liber R-101, page 1 of the Trans-

fers of Patents; that thereafter and on or about the 3rd day of July, 1919, the said George B. Pitts by an instrument in writing that was duly recorded in the United States Patent Office on the 28th day of July, 1919 in Liber Q-107, page 336 of the Transfers of Patents, assigned said undivided one-half of the entire right, title and interest in, to and under said Letters Patent No. 1,092,870 to your Orator, The Cleveland Trust Company; and that the said Louis P. Mooers on the 10th day of July, 1919, by an instrument in writing that was duly recorded in the United States Patent Office on the 28th day of July, 1919, in Liber Q-107, page 339 of the Transfers of Patents, assigned the remaining undivided one-half of the entire right, title and interest in, to and under said Letters Patent No. 1,092,870 to your Orator, The Cleveland Trust Company, whereby your Orator became vested with and holds the entire right, title and interest in, to and under said Letters Patent No. 1,092,870, as will more fully and at large appear upon production in Court of the assignments aforesaid.

[fol. 2288] 6

That heretofore and prior to the 2nd day of June, 1917, Louis P. Mooers, a citizen of the United States, then residing at Cincinnati, Hamilton County, State of Ohio, was the original, first and true inventor of certain new and useful improvements in Pistons for Internal Combustion Motors, fully described in Letters Patent of the United States No. 1,402,309, hereinafter mentioned, which invention or improvement was not known or used by others in this country or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his application for said Letters Patent, had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public, and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States therefor; that the said Louis P. Mooers made due application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress, for Letters Patent of the United States for said invention and improvement.

7

That by an instrument in writing duly executed and delivered by said Louis P. Mooers and duly recorded in the United States Patent Office in Liber P. 103, page 133 of the Transfers of Patents, said Louis P. Mooers assigned an undivided half of the entire right, title and interest in, and to said invention and improvement and in and to said application for Letters Patent to George B. Pitts of Cleveland, Ohio and authorized and requested the Commissioner of Patents to issue the Letters Patent upon said application and for said invention and improvement to said George B. Pitts and Louis P. Mooers; and by said instruments in writing specified in Article 3 of this Bill as recorded in Liber Q-107, pages 336 and 339 of the Transfers of Patents, said George B. Pitts and Louis P. Mooers respectively each assigned his undivided one-half of the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,402,309 to your Orator, The Cleveland Trust Company, and authorized and requested the Commissioner [fol. 2289] of Patents to issue the Letters Patent upon said application and for said invention and improvement to said The Cleveland Trust Company; whereby your Orator became vested with and holds the entire right, title and interest in, to and under said Letters Patent No. 1,402,309, as will more fully and at large appear upon production in Court of the said Letters Patent and the assignments aforesaid.

8

That heretofore and prior to the 1st day of August, 1914, Gustave E. Franquist deceased, then a citizen of the United States residing in the City of New Brunswick, County of Middlesex and State of New Jersey, was the original, first and sole inventor of certain new and useful improvements in Pistons, fully described in Letters Patent of the United States No. 1,153,902, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country prior to his invention thereof for more than two years prior to his application for Letters Patent, and had not been in public use or on sale in this country for more than two years prior to said application, and had not been abandoned to the public, and had not been patented or caused to be patented by him or his

legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States therefor; that said Gustave E. Franquist made such application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress for Letters Patent of the United States for said invention or improvement and, having in all respects complied with the conditions and requirements of said Acts of Congress, on or about the 21st day of September, 1915, Letters Patent of the United States No. 1,153,902, signed, sealed and executed in due form of law for the said invention or improvement, were issued and delivered unto said Gustave E. Franquist, whereby there was secured to him, his successors and assigns, for the term of seventeen years from the said 21st day of September, 1915, the sole and exclusive right to make, use and sell to others to be used throughout the United States and the territories thereof, pistons embodying the aforesaid invention or improvements, all by said Letters Patent or [fol. 2290] a duly authenticated copy thereof in Court to be produced and shown unto Your Honors, as will more fully and at large appear.

9

That subsequent to the granting of the aforesaid Letters Patent, namely on or about the 16th day of May, 1924, by an instrument in writing that was duly recorded in the United States Patent Office on or about the 9th day of June, 1924, in Liber 121 of the Transfers of Patents, page 199, said Gustave E. Franquist assigned the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,153,902 to your Orator, The Cleveland Trust Company; whereby your Orator became vested with and now owns and holds the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,153,902, as will more fully and at large appear upon production in Court of the assignments aforesaid.

10

That heretofore and prior to the 22nd day of May, 1920, Roland M. Howdeshell, a citizen of the United States then residing in the City of St. Louis, County of

St. Louis and State of Missouri, was the original, first and sole inventor of certain new and useful improvements in Pistons for Engine Cylinders, as fully described in Letters Patent of the United States No. 1,473,233, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country prior to his invention thereof, or more than two years prior to his application for Letters Patent; had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public, and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States therefor; that said Roland M. Howdeshell made due application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress for Letters Patent of the United States for said invention or improvement.

[fol. 2291] 11

That by an instrument in writing duly signed, sealed and delivered on or about the 20th day of May, 1920, and duly recorded in the United States Patent Office on or about the 22nd day of May, 1920, in Liber H-110, page 170 of the Transfers of Patents, the said Roland M. Howdeshell did sell, assign and transfer to H. & H. Machine Company, a corporation of Missouri having its principal place of business at St. Louis, Missouri, the entire right, title and interest in and to the said invention and application for Letters Patent and Letters Patent to issue thereon, and said Roland M. Howdeshell, having in all respects duly complied with the conditions and requirements of said Acts of Congress, and after due examination of the aforesaid application, the Commissioner of Patents did, on or about the 6th day of November, 1923, grant and deliver said Letters Patent of the United States No. 1,473,233 to said H. & H. Machine Company, in the name of the United States of America; whereby there was granted to said H. & H. Machine Company, its successors and assigns, the exclusive right to make use of said invention throughout the United States and the territories thereof, for the term of seventeen years from

the said 6th day of November, 1923, as will more fully and at large appear by the production in this Court of a duly authenticated copy of said Letters Patent.

12

That subsequent to the granting of the aforesaid Letters Patent No. 1,473,233, said H. & H. Machine Company, by an instrument in writing dated the 16th day of March, 1925 and duly recorded in the United States Patent Office on or about the 13th day of April, 1925 in Liber W-123, pages 440 and 442 of the Transfers of Patents, said H. & H. Machine Company assigned the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,473,233 to The Cleveland Trust Company, plaintiff, whereby plaintiff became vested with and now holds the entire right, title and interest in, to and under said Letters Patent No. 1,473,233, as will more fully and at large appear upon production in Court of the assignments aforesaid.

13

That on or about the 20th day of August, 1925, said Roland M. Howdeshell and said The Cleveland Trust Com-
[fol. 2292] pany, verily believing that the aforesaid Letters Patent of the United States No. 1,473,233 were inoperative for the reason that the specification thereof was defective, and that such defect consisted particularly in the failure of the patent to claim broadly the novel features of the invention therein disclosed, said Letters Patent were surrendered to the United States Patent Office and an application for re-issue of the aforesaid Letters Patent was made by said Roland M. Howdeshell and his assignee, The Cleveland Trust Company, plaintiff.

14

That after due examination of said application for re-issue of said Letters Patent, the Commissioner of Patents did, on or about the 23rd day of February, 1926, grant and deliver to plaintiff, The Cleveland Trust Company, as assignee of said H. & H. Machine Company, in the name of the United States of America, United States re-issue Letters Patent No. Re-16,273; whereby there was granted to plaintiff, its successors and assigns, the exclusive right, for the term of seventeen years from said 23rd day of February, 1926, to make, use and sell pistons embodying said

inventions throughout the United States and the territories thereof, as will more fully and at large appear by production here in this Court of the original of said Re-issue Letters Patent Re-16,273.

15

That heretofore, and prior to the third day of January, 1921, Howard E. Maynard, then residing at Detroit, in the County of Wayne and State of Michigan, was the original, first and true inventor of certain new and useful improvements in Pistons fully described in Letters Patent of the United States No. 1,655,968 hereinafter mentioned, which invention or improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country before his said invention or discovery thereof, or more than two years prior to his application for Letters Patent therefor, and had not been in public use or on sale in this country for more than two years prior to his application for Letters Patent therefor; and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of the application for Letters Patent thereon in this country.

[fol. 2293] 16

That the said Howard E. Maynard, being as aforesaid, the inventor of the said improvement, made application to the Commissioner of Patents of the United States for Letters Patent in accordance with the then existing Acts of Congress, and, having in all respects complied with the conditions and requirements of said Acts of Congress, on the tenth day of January, 1928 Letters Patent of the United States numbered 1,655,968, signed, sealed and executed in due form of law, for the said invention or improvement, were issued to said Chrysler Corporation, a corporation of Delaware, at Highland Park, Michigan, plaintiff, and Aluminum Company of America, a corporation of Pennsylvania, at Pittsburgh, Pa., as assignees each of one-half of the entire right, title and interest in and to said Letters Patent, whereby there was secured to Chrysler Corporation and Aluminum Company of America for the term of seventeen years from the tenth day of January, 1928, the sole

and exclusive right to make, use and sell to others to be used throughout the United States and the territories thereof, the aforesaid invention or improvement, all as by said Letters Patent, or a duly authenticated copy thereof here in Court to be produced and shown unto Your Honors, as will more fully and at large appear.

17

That prior to the filing of this Bill of Complaint, said Aluminum Company of America, by an instrument in writing dated February 23, 1928 and recorded in the Transfers of Patents in the United States Patent Office as of May 12, 1930 in Liber Z-143, page 283, assigned its undivided one-half interest in the entire right, title and interest in and to said Letters Patent No. 1,655,968 to The Cleveland Trust Company, plaintiff herein, together with the right to sue for and recover damages for past infringements of said Letters Patent, whereby your plaintiff, The Cleveland Trust Company, became vested with and now holds an undivided one-half interest in the entire right, title and interest in, to, and under said Letters Patent No. 1,655,968, as will more fully and at large appear upon production in Court of the assignments aforesaid.

[fol. 2294]

18

That the plaintiff, Chrysler Corporation, is a non-resident, and resides without the jurisdiction of this Court and therefore cannot be served with process and made a co-defendant in this cause, and that plaintiff, The Cleveland Trust Company, has advised Chrysler Corporation of the imminent pendency of this case and of the obligation of Chrysler Corporation to join voluntarily in the bringing of this suit, but that Chrysler Corporation has refused or declined to so voluntarily join and that the plaintiff, The Cleveland Trust Company, is without remedy on the Maynard patent unless Chrysler Corporation is joined as a co-plaintiff in this cause, and therefore to prevent a failure of justice and to enable The Cleveland Trust Company to protect its interests herein, the Chrysler Corporation is made a plaintiff herein without its consent.

19

That heretofore and prior to the 11th day of March, 1920, Frank Jardine, a citizen of the United States, then residing

at Cleveland, in the County of Cuyahoga and State of Ohio, was the original, first and true inventor of certain new and useful improvements in Pistons, fully described in Letters Patent of the United States No. 1,763,523, hereinafter mentioned, which invention or improvement was not known or used by others in this country or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his application for said Letters Patent; had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public, and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States therefor; that the said Frank Jardine made due application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress, for Letters Patent of the United States for said invention and improvement, and having in all respects complied with the conditions and requirements of said Acts of Congress, and having, by mesne assignments, as will more fully and at large appear upon produc- [fol. 2295] tion in Court of said assignments, assigned his entire right, title and interest in and to said Letters Patent No. 1,763,523 to The Cleveland Trust Company, as a Trustee, and having authorized and requested the Commissioner of Patents to issue the Letters Patents upon said application and for said invention and improvements to said The Cleveland Trust Company, on or about the 10th day of June, 1930, Letters Patent of the United States No. 1,763,523, signed, sealed and executed in due form of law, for the said invention or improvement, were issued and delivered to plaintiff, The Cleveland Trust Company, whereby there was secured to it, its successors and assigns, for the term of seventeen years from the said 10th day of June, 1930, the sole and exclusive right to make, use, and sell to others to be used, throughout the United States and the territories thereof, the aforesaid invention or improvement, all as by said Letters Patent or a duly authenticated copy thereof in Court to be produced and shown unto Your Honors, will more fully and at large appear.

20

That heretofore and prior to the 14th day of July, 1917, Victor E. Schmiedeknecht, a citizen of the United States then residing at Louisville in the County of Jefferson and State of Kentucky, was the first and true inventor of certain new and useful improvements in Pistons, fully described in Letters Patent of the United States No. 1,256,265, hereinafter mentioned, which invention and improvement was not known or used by others in this country, or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his application for said Letters Patent; had not been in public use or on sale in this country for more than two years prior to said application; had not been abandoned to the public, and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of his application for Letters Patent of the United States therefor; that the said Victor E. Schmiedeknecht made due application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress, for Letters Patent of the United States for said invention and im-[fol. 2296] provement, and having in all respects complied with the conditions and requirements of said Acts of Congress, on the 12th day of February, 1918, Letters Patent of the United States No. 1,256,265, signed, sealed and executed in due form of law for the said invention or improvement, were issued and delivered unto said Victor E. Schmiedeknecht, his successors and assigns, for the term of seventeen years from said 12th day of February, 1918, the sole and exclusive right to make, use and sell to others to be used, throughout the United States and the territories thereof, the aforesaid invention or improvement, all as by said Letters Patent or a duly authenticated copy thereof in Court to be produced and shown to Your Honors will more fully and at large appear.

21

That subsequent to the granting of the aforesaid Letters Patent No. 1,256,265, by an instrument in writing that was duly recorded in the United States Patent Office on or about

the 16th day of August, 1927 in Liber F-131, page 79 of the Transfers of Patents, said Victor E. Schmiedeknecht assigned the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,256,265, together with the right to sue for, collect, and retain damages and profits for past infringement under said Letters Patent to one Frank Kent of New York City; and, whereas this assignment was further amplified by further warranty and guarantee that was also recorded in the United States Patent Office on or about the 16th day of August, 1927 in Liber P-131, page 81 of the Transfers of Patents; whereby said Frank Kent, his successors and assigns, became vested with the entire right, title and interest in, to and under said Letters Patent of the United States No. 1,256,265, together with the right to sue for, collect, and retain damages and profits for past infringements of said Letters Patent.

22

That by an instrument in writing dated October 12, 1927. and duly recorded in the United States Patent Office in the Transfers of Patents, said Frank Kent assigned the entire right, title and interest in, to and under said Letters Patent of the United States, together with the right to sue, collect, and retain damages and profits for past infringement, to Bohn Aluminum & Brass Corporation of Detroit, Michigan, its successors and assigns.

[fol. 2297] 23

That said Bohn Aluminum & Brass Corporation, by an instrument in writing dated on or about August 31st, 1927, and recorded in the United States Patent Office in Liber C-133, page 618 of the Transfers of Patents, assigned to Your Orator, The Cleveland Trust Company, its successors and assigns, the entire right, title and interest in, to and under said Letters Patent, together with the right to sue for, collect and retain damages and profits for past infringements of said Letters Patent; whereby plaintiff, The Cleveland Trust Company became vested with and now holds the entire right, title and interest in, to and under the aforesaid Letters Patent No. 1,256,265, and the right to sue for, collect and retain damages and profits for past infringement of said Letters Patent, as will more fully and at large appear upon production in this Court of the assignments aforesaid or duly authenticated copies thereof.

24

That heretofore and prior to the 30th day of November, 1917, Edward J. Gulick, a citizen of the United States then residing in Mishawaka, County of St. Joseph, and State of Indiana was the original, first and true inventor of certain new and useful improvements in Pistons, fully described in application for Letters Patent of the United States, Serial No. 204,661, which invention was not known or used by others in this country or patented or described in any printed publication in this or any foreign country, prior to his invention thereof, or more than two years prior to his said application for Letters Patent therefor; that said invention had not been in public use or on sale in this country for more than two years prior to said application for Letters Patent, had not been abandoned to the public and had not been patented or caused to be patented by him or his legal representatives or assigns in any foreign country upon an application filed more than twelve months prior to the filing of said application for Letters Patent of the United States; that on or about November 30, 1917, said Edward J. Gulick made due application to the Commissioner of Patents of the United States in accordance with the then existing Acts of Congress, for Letters Patent of the United States for said invention or improvements and, having in all respects complied with the conditions and requirements of said Acts of Congress, on the 21st day of [fol. 2298] July, 1931, Letters Patent of the United States No. 1,815,773 were signed, sealed and executed in due form of law for the said invention, and were issued and delivered unto Plaintiff, The Cleveland Trust Company, its successors and assigns, as assignee of the entire right, title and interest of said Edward J. Gulick, for the term of seventeen years from said 21st day of July, 1931, thereby granting to it the sole and exclusive right to make, use and sell to others to be used, throughout the United States, its territories and dependencies, the aforesaid invention or improvements, all as by said Letters Patent or a duly authenticated copy thereof in Court to be produced and shown to Your Honor, as will more fully and at large appear.

25

That prior to the grant of aforesaid Letters Patent No. 1,815,773, said Edward J. Gulick assigned to the Packard

Motor Car Company of Detroit, Michigan, his entire right, title and interest in and to the invention set forth and described in the aforesaid application for Letters Patent Serial No. 204,661 by an instrument in writing dated Nov. 23, 1917 that was duly recorded in the United States Patent Office on or about the 30th day of November, 1917, in Liber J-103, page 468 of the Transfers of Patents; whereby said Packard Motor Car Company of Detroit, Michigan, its successors and assigns became vested with the entire right, title and interest in and to the aforesaid invention and in and to said application for Letters Patent Serial No. 204,661 and in and to any Letters Patent issuing pursuant thereto.

26

That, on or about September 11, 1922 and prior to the grant of aforesaid Letters Patent No. 1,815,773, the Packard Motor Car Company of Detroit, Michigan, assigned to The Cleveland Trust Company of Cleveland, Ohio, its entire right, title and interest in and to the invention set forth and described in the aforesaid application for Letters Patent Serial No. 204,661 and in and to said application for Letters Patent by an instrument in writing dated September 11, 1922 that was duly recorded in the United States Patent Office on or about the 13th day of September, 1922, in Liber S-116, page 485 of the Transfers of Patents, whereby said The Cleveland Trust Company of Cleveland, Ohio, its [fol. 2299] successors and assigns became vested with, has continuously held and now owns the entire right, title and interest in and to said invention and in and to said application for Letters Patent Serial No. 204,661 and in and to said Letters Patent of the United States No. 1,815,773 that issued pursuant thereto.

27

That the validity of each of the aforesaid Letters Patent has been recognized and acquiesced in by the public generally since the date of issue of each of said patents, except for these defendants and others encouraged by them. At various times said patents have been especially recognized and acquiesced in by parties who have discontinued infringement thereof and who have made due amends to plaintiff. Others have taken licenses under said patents. Substantial and material royalties have been paid to the

plaintiff under said patents. The licensees under said patents have manufactured and sold the pistons covered by said patents in great numbers. These pistons have gone into extensive and successful use. Licensees under said patents have built plants and established organizations for the manufacture and sale of such pistons on the strength of and by reason of their confidence in the patents here in suit.

28

That plaintiff has duly notified each and both of these defendants of their infringement of each of the aforesaid Letters Patent and has requested them and each of them to desist, but defendants and each of them have continued their infringements in defiance of said notices.

29

These defendants, The Simmons Manufacturing Company and Sterling Products Corporation, jointly and severally, subsequent to the grant of said Letters Patent and prior to the filing of this Bill of Complaint and within six years hereof, with full knowledge of each of said Letters Patent and without the consent of plaintiff, The Cleveland Trust Company, but in violation of its rights, and after due notice, has within the Judicial District of this Court and elsewhere within the United States, infringed each of the [fol. 2300] aforesaid Letters Patent and contributed to the infringement thereof by making and/or causing to be made, by using and/or causing to be used, and selling and/or causing to be sold in this Judicial District and elsewhere within the United States, Pistons for Internal Combustion Engines embodying jointly and severally the inventions of said Letters Patent and in infringement thereof.

That in so infringing, defendants have realized and received great gains and profits which should, and otherwise would, have been received by plaintiffs, each and both of them, and defendants, and each and both of them have correspondingly inflicted on plaintiffs great loss and damage, but to what extent plaintiffs cannot now set forth and therefore pray discovery with respect thereto; that plaintiffs fear and have reason to fear that defendants will continue their aforesaid infringing acts to an even greater extent unless enjoined by this Honorable Court; and de-

fendants, and each of them, have and will thereby induce others to venture to infringe the said Letters Patent aforesaid, to the irreparable injury of plaintiffs.

30

Because of these premises, plaintiffs are without adequate or sufficient remedy at law and therefore bring this suit in equity.

Wherefore, the plaintiffs pray:

First. That a writ of subpoena ad respondum may issue out of and under the seal of this Court requiring each and both of said defendants, The Simmons Manufacturing Company and Sterling Products Corporation, to appear and make answer to this Bill of Complaint, but not under oath, answer under oath being hereby expressly waived, to the best and utmost of their knowledge, information and belief and to do and perform such things as to this Court may seem meet and just;

Second. That this Court may grant an injunction, perpetual as well as temporary, enjoining each and both of said defendants, The Simmons Manufacturing Company and Sterling Products Corporation, as well as each of the directors, officers, associates, successors, agents, attorneys and employees, and every person acting for or on the behalf of each and/or both of said defendants, from further infringing or contributing to the infringment of any and/or each of said Letters Patent;

[fols. 2301-2356] *Third.* That said defendants, The Simmons Manufacturing Company and Sterling Products Corporation, and each and both of them, may be required to account before a Master in the usual manner of accountings for the gains, profits and advantages due to and arising out of their aforesaid infringements and contributory infringements herein complained about, as well as the damages sustained by plaintiffs, by reason of said infringements;

Fourth. That said defendants, The Simmons Manufacturing Company and Sterling Products Corporation, each and both of them, be required to pay over to plaintiffs, the gains and profits so accounted for and also the damages sustained by plaintiffs as the result of said infringements and contributory infringements;

Fifth. That the defendants, each and both of them, be decreed to pay the costs, charges and disbursements of this suit;

Sixth. That the plaintiffs may have such other and further relief as the equity of the case may require, and as to this Honorable Court may seem just and proper.

The Cleveland Trust Company, By: —— ——, Vice President; Chrysler Corporation, By: —— ——, Vice-President, The Cleveland Trust Company. —— ——, Solicitor for Plaintiffs.

AFFIDAVIT

STATE OF OHIO,
County of Cuyahoga, ss.

On this 1st day of August, 1931, before the undersigned, a Notary Public within and for the County and State aforesaid, personally appeared R. A. Malm and made oath that he is the Vice President of The Cleveland Trust Company, the above named complainant, that he has read the foregoing Bill of Complaint, and knows the contents thereof, and that the same is true, except as to those matters stated on information and belief, and as to those matters he believes it to be true.

D. F. KING, *Notary Public.*

. . . . . .

[fols 2357-2363] **CERTIFICATE OF CLERK**

NORTHERN DISTRICT OF OHIO, ss.:

I, F. J. Denzler, Clerk of the United States District Court within and for said district, do hereby certify that the foregoing printed pages contain a full, true and complete copy of the records and all proceedings in the consolidated causes of Nos. 4045, 4046 and 4047 Equity, including the petitions for appeal, assignments of error, orders allowing appeal, bonds on appeal, and other pleadings in accordance with the praecipes for transcript filed herein, the originals of which papers, except certain original exhibits withdrawn by leave of court, remain in my custody as clerk of said court.

There are also attached hereto and transmitted herewith the citations issued and allowed herein.

In Testimony Whereof, I have hereunto signed my name and affixed the seal of said court at Cleveland, in said district, this — day of October, A. D 1935 and in the one hundred and sixtieth year of the Independence of the United States of America.

F. J. Denzler, *Clerk,*
(Seal) By C. B. Watkins,
Chief Deputy.

[fol. 2364] Caption

United States of America,
Northern District of Ohio, Eastern Division, ss:

Record of the proceedings of the District Court of the United States within and for the Eastern Division of the Northern District of Ohio, in the causes and matters hereinafter stated, the same being finally disposed of at a regular term of said court begun and held at the City of Cleveland, in said district, on the first Tuesday in April, being the third day of said month, in the year of our Lord one thousand nine hundred and thirty-four and in the one hundred and fifty-eighth year of the Independence of the United States of America, to-wit, on Friday, the 27th day of July, A. D. 1934.

Honorable Paul Jones, *United States District Judge.*

No. 4046. Equity.

The Cleveland Trust Company, Chrysler Corporation,

vs.

The Aberdeen Motor Supply Company

Said action was commenced on the 17th day of October, A. D. 1931 and proceeded to final disposition at the term and day above written and during the progress thereof pleadings and papers were filed, process was issued and returned and orders of the court were made and entered in the order and on the dates hereinafter stated, to-wit:

[fol. 2365] In United States District Court

Assignment of Errors

Filed April 17, 1936

[Case No. 4046]

Now come plaintiffs, The Cleveland Trust Company and Chrysler Corporation, and present with their accompanying

petition for appeal from the final decree entered herein, the following assignment of errors, which are hereinafter grouped with respect to subject matter:

Group A

Assignment of errors relating to the validity of Gulick patent No. 1,815,733.

1. The Court erred in failing to find and hold the Gulick patent No. 1,815,733 good and valid in law, particularly as to claims 1, 11, 12, 13, 15, 18, 22, 27, 28, 29, 30, 33, 35, 36, 37, 38, 41, 42 and 43 thereof, and in failing to sustain plaintiffs' exceptions Nos. 2, 3 and 101.

Assignments 2 to 27, inclusive, same as in case 4045 (R. pp. 1233 to 1239).

Group B

Assignment of errors relating to infringement of the Gulick patent in suit.

28. The Court erred in not holding that defendant has infringed the Gulick patent No. 1,815,733, particularly as to claims 1, 11, 12, 13, 15, 18, 22, 27, 28, 29, 30, 33, 35, 36, 37, 38, 41, 42 and 43 thereof, and in failing to sustain plaintiffs' exceptions Nos. 45 and 102.

29. The Court erred in approving and adopting the Special Master's finding of fact No. 38:

"That defendants' pistons, Exs. 1, * * * and 8 do not embody the structure, function and mode of operation of the Gulick patent in suit."

and in not sustaining plaintiffs' exception (No. 44) to the aforesaid finding of fact No. 38.

30. The Court erred in approving and adopting the Special Master's finding of fact No. 43 and in not sustaining plaintiffs' exception (No. 54) to the following statements and conclusions in the aforesaid finding of fact No. 43:

(a) "* * * that the prior art requires restriction of the (Gulick) patent to the employment of webs which are of sufficient length and thinness to permit flexing of those [fol. 2366] webs at the top of the skirt;

(b) that Exhibit 1 does not employ such characteristic webs;

(c) that Exhibit 8 does not employ such characteristic webs; * * *."

Assignment 31 same as in case 4045 (R. p. 1240).

32. The Court erred in approving and adopting the Special Master's finding of fact No. 49,

"That such construction and arrangement (of the connectors from the head to the wrist pin boss in Exhibit 8) does not secure the mode of operation contemplated by the Gulick and Jardine patents."

and in not sustaining plaintiff's exception (No. 60) to the aforesaid finding of fact No. 49.

33. The Court erred in approving and adopting the Special Master's finding of fact No. 51:

"That defendants' pistons, Exs. 1, * * * 8 and 9 employ the essential structure, function and mode of operation of the prior art, more particularly the Franquist patent No. 1,153,902 and Exs. 8 and 9, also the Chenard & Walcker French patent No. 468,595."

and in not sustaining plaintiffs' exception (No. 62) to the aforesaid finding of fact No. 51.

34. The Court erred in approving and adopting the Special Master's conclusion of law No. 37:

"That defendant's pistons, Exs. 1, * * * and 8 do not infringe the Gulick patent in suit."

and in not sustaining plaintiffs' exception (No. 89) to the aforesaid conclusion of law.

Group C

Assignment of errors relating to validity of the Jardine patent No. 1,763,523.

Assignments 35 to 41, inclusive, same as 34 to 40, inclusive, in case 4045 (R. pp. 1241 to 1242).

Group D

Assignment of errors relating to infringement of Jardine patent in suit.

Assignment 42 same as 41 in case 4045 (R. p. 1242).

[fol. 2367] 43. The Court erred in approving and adopting the Special Master's finding of fact No. 39:

"That defendants' pistons, Exhibits 1, * * * and 8 do not embody the structure, function and mode of operation of the Jardine patent in suit."

and in not sustaining plaintiffs' exception (No. 46) to the aforesaid finding of fact No. 39.

44. The Court erred in approving and adopting the Special Master's finding of fact No. 44 and in not sustaining plaintiffs' exception (No. 55) to the following statements and conclusions in finding of fact No. 44:

(a) "* * * that the prior art requires restriction of the patent (Jardine) to the employment of webs which are of sufficient lengths and thinness to permit flexing of these webs at the top of the skirt;

(b) that Ex. 1 does not employ such characteristic webs;

(c) that Ex. 8 does not employ such characteristic webs."

45. The Court erred in approving and adopting the Special Master's conclusion of law No. 38:

"That defendants' pistons, Exs. 1, * * * and 8 do not infringe the Jardine patent in suit."

and in not sustaining plaintiffs' exception (No. 90) to the aforesaid conclusion of law No. 38.

Groups and Assignments 46 to 67, inclusive, same as 45 to 66, inclusive, in case 4045 (R. pp. 1243 to 1247).

Group H

Assignment of errors relating to infringement of Mooers patent in suit.

Assignment 68 same as 67 in case 4045 (R. p. 1248).

69. The Court erred in approving and adopting the Special Master's finding of fact No. 41:

"That defendants' pistons, Exs. 1, * * * 8 and 9 do not embody the structure, function and mode of operation of the Mooers patent in suit."

and in not sustaining plaintiffs' exception (No. 50) to the aforesaid finding of fact No. 41.

70. The Court erred in approving and adopting the Special Master's finding of fact No. 46 and in not sustaining [fols. 2368-2369] plaintiffs' exception (No. 57) to the following statements and conclusions included in the Special Master's finding of fact No. 46:

(a) "* * * that the prior art requires such a restriction; (of the connectors from the head to the top of the skirt in the Mooers patent to narrow connectors of restricted cross sections);

(b) that in Exs. 1, * * * 8 and 9 the connectors are heavy and not of a structure as described in the Mooers patent * * *."

71. The Court erred in approving and adopting the Special Master's conclusion of law No. 40:

"That defendants' pistons, Exs. 1, * * * 8 and 9 do not infringe the Mooers patent in suit."

and in not sustaining plaintiffs' exception (No. 92) to the aforesaid conclusion of law No. 40.

Groups and Assignments 72 to 82, inclusive, same as 71 to 81, inclusive, in case 4045 (R. pp. 1248 to 1250).

* * * * * * * * *

[fol. 2370] CAPTION

UNITED STATES OF AMERICA,
Northern District of Ohio, Eastern Division, ss:

Record of the proceedings of the District Court of the United States within and for the Eastern Division of the Northern District of Ohio, in the causes and matters hereinafter stated, the same being finally disposed of at a regular term of said court begun and held at the City of Cleveland, in said district, on the first Tuesday in April, being the third day of said month, in the year of our Lord one thousand nine hundred and thirty-four and in the one hundred and fifty-eighth year of the Independence of the United

States of America, to-wit, on Friday, the 27th day of July, A. D. 1934.

Honorable Paul Jones, United States District Judge.

No. 4047. Equity.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION,

vs.

THE F. E. ROWE SALES COMPANY

Said action was commenced on the 17th day of October, A. D. 1931 and proceeded to final disposition at the term and day above written and during the progress thereof pleadings and papers were filed, process was issued and returned and orders of the court were made and entered in the order and on the dates hereinafter stated, to-wit:

[fol. 2371] IN UNITED STATES DISTRICT COURT

ASSIGNMENT OF ERRORS—Filed April 17, 1936

[Case No. 4047]

Now come plaintiffs, The Cleveland Trust Company and Chrysler Corporation, and present with their accompanying petition for appeal from the final decree entered herein, the following assignment of errors, which are hereinafter grouped with respect to subject matter:

Group A

Assignment of errors relating to the validity of Gulick patent No. 1,815,733.

1. The Court erred in failing to find and hold the Gulick patent No. 1,815,733 good and valid in law, particularly as to claims 1, 4, 11, 12, 13, 15, 18, 22, 27, 28, 29, 30, 33, 34, 35, 36, 37, 38, 41, 42 and 43 thereof, and in failing to sustain plaintiffs' exceptions Nos. 2, 3, and 101.

Assignments 2 to 27, inclusive, same as in case 4045. (R. pp. 1233 to 1239.)

Group B

Assignment of errors relating to infringement of the Gulick patent in suit.

28. The Court erred in not holding that defendant has infringed the Gulick patent No. 1,815,733, particularly as to claims 1, 4, 11, 12, 13, 15, 18, 22, 27, 28, 29, 30, 33, 34, 35, 36, 37, 38, 41, 42 and 43 thereof, and in failing to sustain plaintiffs' exceptions Nos. 45 and 102.

29. The Court erred in approving and adopting the Special Master's finding of fact No. 38,

"That defendants' pistons, Exs. 1, BBB, CCC, 3-J, 3-O and 8 do not embody the structure, function and mode of operation of the Gulick patent in suit."

and in not sustaining plaintiffs' exception (No. 44) to the aforesaid finding of fact No. 38.

30. The Court erred in approving and adopting the Special Master's finding of fact No. 43 and in not sustaining plaintiffs' exception (No. 54) to the following statements and conclusions in the aforesaid finding of fact No. 43:

(a) " * * * that the prior art requires restriction of the (Gulick) patent to the employment of webs which are of [fol. 2372] sufficient length and thinness to permit flexing of those webs at the top of the skirt;

(b) that Exhibit 1 does not employ such characteristic webs;

(c) that Exhibit 8 does not employ such characteristic webs; and

(d) that Exhibits BBB and CCC * * * employ no webs at all."

Assignment 31 same as in case 4045 (R. p. 1240).

32. The Court erred in approving and adopting the Special Master's finding of fact No. 49,

"That such construction and arrangement (of the connectors from the head to the wrist pin boss in Exhibit 8) does not secure the mode of operation contemplated by the Gulick and Jardine patents."

and in not sustaining plaintiffs' exception (No. 60) to the aforesaid finding of fact No. 49.

33. The Court erred in approving and adopting the Special Master's finding of fact No. 50 and in not sustaining plaintiffs' exception (No. 61) to the following statements and conclusions in the said finding of fact No. 50:

"That Exs. BBB and CCC * * * do not employ any webs connecting the head with the skirt and, therefore, no webs of such flexibility as contemplated by the Gulick, Jardine and even Maynard patents, if the latter has such webs having such characteristics."

34. The Court erred in approving and adopting the Special Master's finding of fact No. 51,

"That defendants' pistons, Exs. 1, BBB, CCC, 3-J, 3-O, 8 and 9 employ the essential structure, function and mode of operation of the prior art, more particularly the Franquist patent No. 1,153,902 and Exs. 8 and 9, also the Chenard & Walcker French patent No. 468,595."

and in not sustaining plaintiffs' exception (No. 62) to the aforesaid finding of fact No. 51.

35. The Court erred in approving and adopting the Special Master's conclusion of law No. 37,

[fol. 2373] "* * * that defendants' pistons, Exs. 1, BBB, CCC, 3-J, 3-O and 8 do not infringe the Gulick patent in suit."

and in not sustaining plaintiffs' exception (No. 89) to the aforesaid conclusion of law.

Group C

Assignment of errors relating to validity of the Jardine patent No. 1,763,523.

Assignments 36 to 42, inclusive, same as assignments 34 to 40, inclusive, of case 4045 (R. pp. 1241 to 1242).

Group D

Assignment of errors relating to infringement of Jardine patent in suit.

Assignment 43 same as 41 in case 4045 (R. pp. 1242).

44. The Court erred in approving and adopting the Special Master's finding of fact No. 39,

"That defendants' pistons, Exhibits 1, BBB, CCC, and 8 do not embody the structure, function and mode of operation of the Jardine patent in suit."

and in not sustaining plaintiffs' exception (No. 46) to the aforesaid finding of fact No. 39.

45. The Court erred in approving and adopting the Special Master's finding of fact No. 44 and in not sustaining plaintiffs' exception (No. 55) to the following statements and conclusions in finding of fact No. 44:

(a) "* * * that the prior art requires restriction of the patent (Jardine) to the employment of webs which are of sufficient lengths and thinness to permit flexing of these webs at the top of the skirt;

(b) That Ex. 1 does not employ such characteristic webs;
(c) that Ex. 8 does not employ such characteristic webs;
(d) that Exs. BBB and CCC employ no webs at all."

46. The Court erred in approving and adopting the Special Master's conclusion of law No. 38,

[fol. 2374] "That defendants' pistons, Exs. 1, BBB, CCC and 8 do not infringe the Jardine patent in suit."

and in not sustaining plaintiffs' exception (No. 90) to the aforesaid conclusion of law No. 38.

Group E

Assignment of errors relating to validity of the Maynard patent No. 1,655,968.

Assignments 47 to 56, inclusive, same as 45 to 54, inclusive, in case 4045 (R. pp. 1243 to 1245).

Group F

Assignment of errors relating to infringement of Maynard patent in suit.

Assignment 57 same as 55 in case 4045 (R. p. 1245).

58. The Court erred in approving and adopting the Special Master's finding of fact No. 40,

"That defendants' pistons, Exs. 1, BBB, CCC do not embody the structure, function and mode of operation of the Maynard patent in suit."

and in not sustaining plaintiffs' exception (No. 48) to the aforesaid finding of fact No. 40.

59. The Court erred in approving and adopting the Special Master's finding of fact No. 45 and in not sustaining plaintiffs' exception (No. 56) to the following statements in the Special Master's finding of fact No. 45:

(a) "That the Maynard patent in suit describes a piston structure in which automatic compensation is not secured unless the groove E is cut into the webs F sufficiently and beyond the inside of the piston head flange to secure web extensions at the top of sufficient length and thinness to permit flexing of these web extensions at the top of the skirt;

(b) that Ex. 1 does not employ such characteristic webs; and

(c) that Exs. BBB and CCC employ no webs at all."

60. The Court erred in approving and adopting the Special Master's conclusion of law No. 39,

"That the defendants' pistons, Exs. 1, BBB, CCC do not infringe the Maynard patent in suit."

and in not sustaining plaintiffs' exception (No. 91) to the aforesaid conclusion of law No. 39.

[fols. 2375-2378] Group G

Assignment of errors relating to validity of Mooers patent No. 1,402,309.

Assignments 61 to 68, inclusive, same as 59 to 66, inclusive, in case 4045 (R. pp. 1246 to 1247).

Group H

Assignment of errors relating to infringement of Mooers patent in suit.

Assignment 69 same as 67 of case 4045 (R. p. 1248).

70. The Court erred in approving and adopting the Special Master's finding of fact No. 41,

"That defendants' pistons, Exs. 1, BBB, CCC, 3-O, 8 and 9 do not embody the structure, function and mode of operation of the Mooers patent in suit."

and in not sustaining plaintiffs' exception (No. 50) to the aforesaid finding of fact No. 41.

71. The Court erred in approving and adopting the Special Master's finding of fact No. 46 and in not sustaining plaintiffs' exception (No. 57) to the following statements and conclusions included in the Special Master's finding of fact No. 46:

(a) "* * * that the prior art requires such a restriction; (of the connectors from the head to the top of the skirt in the Mooers patent to narrow connectors of restricted cross sections);

(b) that in Exs. 1, BBB, CCC, 3-O, 8 and 9 the connectors are heavy and not of a structure as described in the Mooers patent * * *."

72. The Court erred in approving and adopting the Special Master's conclusion of law No. 40:

"That defendants' pistons, Exs. 1, BBB, CCC, 3-O, 8 and 9 do not infringe the Mcoers patent in suit."

and in not sustaining plaintiffs' exception (No. 92) to the aforesaid conclusion of law No. 40.

Remaining groups and Assignments 73 to 83, inclusive, same as 71 to 81 of case 4045 (R. pp. 1249 to 1250).

[fol. 2379] PROCEEDINGS IN THE UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT

CAUSES ARGUED AND SUBMITTED—May 4, 1937

(Before Hicks, Simons and Allen, JJ.)

These causes are argued by Newton D. Baker and F. O. Richey for Appellants and by J. H. Bruninga and J. H. Sutherland for Appellees and are submitted to the court.

Decree—#7223—Entered October 8, 1937

Appeal from the District Court of the United States for the Northern District of Ohio.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Ohio, and was argued by counsel.

On Consideration Whereof, It is now here ordered, adjudged and decreed by this Court that the decree of the said District Court in this cause be and the same is hereby set aside and the cause remanded for the entry of a decree granting the usual relief of injunction and accounting in [fol. 2380] respect to the infringement of claims 1, 11, 12, 13, 15, 18, 30 and 33 of Gulick, and claims 1, 6 and 8 of Maynard patent, which claims are valid and infringed by the Sterling piston, exemplified by Exhibit 1, and dismissing the bill with respect to the alleged infringements of Jardine, Mooers and Schmiedeknecht without prejudice. Costs of the appeal will be borne by the defendant.

Decree—#7224—Entered October 8, 1937

Appeal from the District Court of the United States for the Northern District of Ohio.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Ohio, and was argued by counsel.

On Consideration Whereof, It is now here ordered, adjudged and decreed by this Court that the decree of the said District Court in this cause be and the same is hereby set aside and the cause remanded for the entry of a decree granting the usual relief of injunction and accounting in respect to the infringement of claims 1, 11, 12, 13, 15, 18, 30 and 33 of Gulick, and claims 1, 6 and 8 of Maynard pat-

ent, which claims are valid and infringed by the Sterling [fol. 2381] piston, exemplified by Exhibit 1, and dismissing the bill with respect to the alleged infringements of Jardine, Mooers and Schmiedeknecht without prejudice. Costs of the appeal will be borne by the defendants.

Decree—#7225—Entered October 8, 1937

Appeal from the District Court of the United States for the Northern District of Ohio.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Ohio, and was argued by counsel.

On Consideration Whereof, It is now here ordered, adjudged and decreed by this Court that the decree of the said District Court in this cause be and the same is hereby set aside and the cause remanded for the entry of a decree granting the usual relief of injunction and accounting in respect to the infringement of claims 1, 11, 12, 13, 15, 18, 30 and 33 of Gulick, and claims 1, 6 and 8 of Maynard patent, which claims are valid and infringed by the Sterling piston, exemplified by Exhibit 1, and dismissing the bill with respect to the alleged infringements of Jardine, Mooers and Schmiedeknecht without prejudice. Costs of the appeal will be borne by the defendants.

[fol. 2382] OPINION—Filed October 8, 1937

[fol. 2383] Nos. 7223-4-5

UNITED STATES CIRCUIT COURT OF APPEALS, SIXTH CIRCUIT

No. 7223

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Appellants,

v.

THE SCHRIBER-SCHROTH COMPANY, Appellee

No. 7224

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Appellants,

v.

THE ABERDEEN MOTOR SUPPLY COMPANY, Appellee

No. 7225

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Appellants,

v.

THE F. E. ROWE SALES COMPANY, Appellee

Appeals from the District Court of the United States for the Northern District of Ohio, Eastern Division

Decided October 8, 1937

Before Hicks, Simons and Allen, Circuit Judges

SIMONS, Circuit Judge:

In a study of the patents and prior art involved in Waukesha Motor Co. v. Willys Overland, Inc., 77 Fed. (2d) 906, and The Perfect Circle Co. v. Hastings Mfg. Co., 88 Fed. (2d) 813, we learned something of the principles of operation and the mechanics employed in the conventional four-cycle internal combustion engine of the modern motor car. [fol. 2384] It will therefore be unnecessary here to repeat what was there said in reference thereto. In the first we con-

sidered the explosion chamber, and in the second the piston ring. In the present infringement suit we deal with the piston.

In the rapid reciprocation of a piston within the cylinder, as in the references described, the desirability of maintaining a close fit was obvious and had long been recognized. This was necessary to avoid waste of power through gases being permitted to pass below the piston from the explosion chamber, a condition known as "blow-by," to prevent lubricating oil passing above the piston into the explosion chamber, a condition known as "pumping oil," and to prevent the slapping of the piston in the cylinder, making for a noisy engine and tending to break its parts. On the other hand a too close fit would, because of the expansion of the piston by the great heat generated in the cylinder, cause it to bind or "seize" therein, thus stalling the engine or perhaps even wrecking it.

Cylinders were and generally still are cast of iron, and prior to the period we are here considering pistons were likewise so cast. The disadvantages in this organization were early recognized. Since iron is a poor conductor of heat, the particles of carbon that would form on the cylinder head woud become overheathed and cause premature explosion in the combustion chamber. Iron is also heavy, and with the great acceleration of piston reciprocation, due to the ever increasing demand for speed, the industry began to cast about for expedients to lighten the pistons. There were numerous efforts and failures in this respect with the conventional iron trunk piston. Lighter metals were considered, but since strength and durability to withstand the great force of rapid explosions upon the piston head and the powerful thrust imparted to its bearing faces by the power stroke of the piston as it imparted energy to the crank shaft were prerequisites, the art was limited to metal that was both strong and durable. It turned, therefore, quite naturally and inevitably, to aluminum. A new and for a long time seemingly insuperable problem at once confronted the automotive engineers, due to the fact that the coefficient of expansion differs greatly in the two metals, and that under heat aluminum will expand much more rapidly than iron. Since the desirable clearance is minute, approximately one one-thousandth of an inch, it was at once clear that an aluminum piston, installed when cold with required clearance in an iron cylinder, would when heated

by operation seize, and that a piston with clearance suffi-
[fol. 2385] cient to avoid seizing would waste power, pump oil, cause undesirable noises, and lack durability.

Ingenious, numerous and varied were the expedients resorted to in an effort to achieve the clearly recognized advantages of aluminum pistons, while at the same time avoiding troublesome results, and equally numerous were the failures, by reason of which a prejudice had developed in the industry against them, and it was said they had had a "black eye."

The Cleveland Trust Company, appellant, is the repository of numerous patent rights assigned to it by inventors and by piston and automobile manufacturers, and it is its contention that the aluminum piston problem was completely solved by some of its assignors, and that a structure embodying the disclosures of the patent to Jardine, No. 1,763,523, granted June 10, 1930, but in a more specific and improved form described in Maynard No. 1,655,968, granted January 10, 1928, but on an application later than Jardine's, had gone into wide commercial use, being accepted by the industry, with the exception of some divisions of the General Motors Corporation, had sold in the tens of millions, and is now infringed by pistons of the appellees. The Jardine and Maynard patents belong to the Trust Company. Conceiving, however, that a Gulick application, which was being prosecuted by the Packard Motor Car Company, would, with its broader claims, dominate both Jardine and Maynard, the Trust Company purchased it and prosecuted it to successful conclusion after numerous interferences, the patent issuing as Gulick No. 1,815,733, on July 21, 1931. The Trust Company also owns Schmiedeknecht patent No. 1,256,265, granted February 12, 1918, and Mooers, No. 1,402,309, granted January 3, 1922, both for pistons, and seven accused devices are all alleged to infringe some of the claims of some or all of the five patents.

The appellees are three Cleveland dealers who have sold alleged infringing pistons manufactured by the Sterling Products Corporation of St. Louis, Missouri. While the manufacturer was named in the original bills of complaint, they were dismissed as to it, it being understood, however, that Sterling Products Corporation was conducting the defense of the three suits. By stipulation they were consolidated below, and all are before this court upon the same record. At the outset only two alleged infringing devices were

involved, one a Sterling piston known as Exhibit 1, and the other a Ray-Day piston known as Exhibit 8. During the progress of the trial five additional structures were introduced as infringements. While there is no finding to that [fol. 2386] effect, it seems to have been assumed that all of the alleged infringing devices were sold by each of the three defendants. The consolidated cause was referred to a master, whose very detailed findings of fact and conclusions of law were affirmed by the District Judge without discussion and decrees entered dismissing the bills. While the Chrysler Corporation appears as party plaintiff below and as co-appellant here, it has never entered its appearance and its presence in the case as a nominal plaintiff is due to the fact that it owns a half interest in the Maynard patent and was therefore joined as party plaintiff. An issue raised below as to the propriety of Chrysler being made a nominal party is abandoned here, since the defendants have not appealed.

The controversy is involved and has been bitterly fought. The record is voluminous, the exhibits, physical and otherwise, numerous, the patent office history discloses persistent challenge, and of eighty-odd claims fifty-two are said to be infringed. While we have given careful consideration to the briefs and record, it is manifest that the necessities of the case and the desirable limit of an opinion will permit us to discuss only the more salient features of the controversy, with perhaps summary disposition of its lesser issues, for the challenge to the validity of the patents and to the fact of their infringement includes most if not all of the defenses known to the patent law.

We deal first with the patent to Gulick, in agreement with the contention that if valid it is basic. Gulick had been connected with various motor car and motor cycle manufacturing companies in a number of capacities, including that of factory manager. He was also an inventor, having prosecuted some fifty applications in the patent office. As early as 1908 he had a conception of a split and flexible piston, but did nothing more for several years than to make sketches. In 1911 he made some experiments with modified standard iron pistons, giving them block tests in a motor cycle and in an Excelsior motor. The motor was later put into a Renault car and given a substantial road test. These early pistons were scrapped. In 1914 he made his first test with aluminum pistons in an Amplex car, which he

used personally for some 4500 to 5300 miles. In 1917, along with other patents and patent applications, Gulick assigned his inchoate rights to the Packard Motor Car Company, and the application for the piston patent was filed by it on November 30th of that year. There followed long discussions with the examiners, administrative reviews, bitterly contested interferences, and appeals to the Court of Ap- [fol. 2387] peals of the District of Columbia (Long v. Gulick, 17 Fed. [2d] 686), and to the Court of Customs and Patent Appeals (Hartog v. Long, 47 Fed. [2d] 369). There had also been amendments to the original application at the instance of the inventor's assignee. It was not until July 21, 1931, that the Gulick patent issued with its forty-three claims.

The Gulick patent is for a combination of elements, many, if not indeed all of which, are to be found in the prior art. Nowhere, however, is found his precise organization, and the question at once presents itself as to whether there was exercise of the inventive faculty in the concept of their combination, for that a new result was achieved and a new mode of operation of an aluminum piston in its iron cylinder brought about is not successfully challenged on this record. Gulick separated the smaller ring carrying head of the piston from the somewhat larger skirt by a groove or air gap. This tends to prevent the passage of heat from the head directly to the skirt and permits the bearing faces of the skirt to yield to pressure independently of the head. The wrist pin bosses are pulled inwardly from the skirt periphery, and instead of being supported by the skirt are carried from the piston head by depending flanges, thus providing a vertically rigid support for the bosses with freedom of lateral motion in a direction at right angles to the load thrusts on the piston. The surface of the skirt where the bosses are connected to the head in conventional pistons was cut away or relieved, so that the bosses are not directly constrained by the cylinder wall. They are held in place by webs extending in the general direction of load thrusts on the piston. One bearing face of the skirt is slotted vertically from the bottom edge up to and connecting with the air gap. That Spillman and Mooers patent 1,092,870, and Franquist patent 1,153,902 showed air gaps between piston head and skirt, or that splitting the piston skirt vertically or combining the vertical and longitudinal splits into the

so-called T-slot were old practices, is not conclusive on the question of invention.

Since the cylinder head is the first to heat, and becomes hotter than the skirt it had always been machined with greater clearance, the control of oil and gas flow being taken care of in part at least by the piston rings, which function as a packing. See Perfect Circle Co. v. Hastings, supra. The problem of maintaining a close fit between an aluminum piston and an iron cylinder without seizing under heat expansion is a problem involving the skirt, which guides the [fol. 2388] piston and carries the bearings for the wrist pin, upon which is exerted the thrusts of the connecting rod through the cycle of reciprocation. To decelerate the flow of heat from piston head to skirt by an air gap was perhaps an obvious expedient in the art. To slit the skirt vertically so that pressure of the cylinder wall would compensate for thermal expansion was perhaps not beyond expected skill in the art. Minute relief of the cylinder periphery in the region of the bosses was shown in Franquist. But to combine insulation of head from skirt, retraction of the bosses from the skirt periphery, connection of such bosses to the skirt with webs laterally flexible and yet so carried from the head as to support the load upon the wrist pin with sufficient strength and rigidity, and to utilize the mechanical force of the cylinder wall upon the skirt and the thermal expansion of the bosses so as to compensate evenly and fully for head expansion and to secure a balanced flexibility of the skirt with no bending concentration at any point therein, discloses, we think, a meritorious concept beyond the reach of those skilled in the art. Franquist, of course, does disclose the broad concept of a flexible skirt. But Franquist gives no hint at all of the Gulick invention. His flexibility was obtained by grooves on the accordion principle, which while they interrupted the outer periphery of the piston skirt, did not destroy its inner unity. Some flexibility no doubt it had, but certainly not in the sense that Gulick disclosed it, and it is doubtful that the Franquist piston could have met the severe tests required by the industry. And of commercial history it has none upon this record.

Probably the most difficult task that confronts a patent court lies in determining whether there is invention in a combination whereof many or all cooperating elements are old, and when concepts, however remarkable when disclosed, have in a rapidly developing art already become common-

place, not only to the expert but to the unskilled. It is not easy after the lapse of years to evaluate advances with the "eye and the understanding" of those in the field when they were made. Inventive concept is an abstraction impossible to define, and so courts have sought for simple rules by which its presence may be detected. These have proved helpful, even though never absolute. Long recognition of an existing problem in any art, and the advantages to accrue to an industry from its solution, coupled with repeated failures to find solution, has ever been considered as highly persuasive of invention when success is finally attained. Sometimes achievement is revolutionary, an abandonment of all previous approaches, and the charting of a new way [fol. 2389] to the goal. More often the inventor begins where others leave off, and perceives the vital forward step to which predecessors had been blind. Even then success may not be fully recognized until the world gives acclaim.

The present record is conclusive of the long unsuccessful search for a light weight piston sufficiently durable to obviate the well-known disadvantages of the iron trunk piston in high speed engines. There was much research and experimentation by those most highly skilled, including the engineers of the Aluminum Company, Colonel Vincent of the Packard Motor Car Company, one of the designers of the Liberty engine, and the engineering staff of the Franklin Automobile Company, under the direction of the defendants' expert Stellman, its Chief Engineer. Limited success may here and there have been attained, but the problem in its full sweep was not solved until the Gulick concept, carried forward to some extent by Maynard, with possibly some instruction from Jardine, reached commercial embodiment. Then and then only did the industry, by acceptance of the Aluminum Company's piston answering the Maynard drawing and specification, recognize the complete solution of the problem, and the many millions that have since been sold and used have set the seal of commercial approval upon such solution. It is idle to say in an imperfect world that invention should be denied because no piston, not even Maynard, performs perfectly.

It is, of course, axiomatic that commercial success is not of itself conclusive upon the question of novelty or invention, and where such success is fairly attributable to other causes, such as the reputation of the manufacturer, his extensive advertising and superior salesmanship, it will be

wanting in persuasiveness. But where no alternative inferences are to be drawn, commercial success is highly indicative of invention. This is so in the usual case where the test of success is acceptance by the public. But it must be here noted if not elsewhere observed, that where success follows acceptance by experts rather than by those unskilled, it is of far greater tribute to the ingenuity of the inventor. It is clearly demonstrated upon this record, if indeed it is not within the field of general knowledge, that the automotive industry in acceptance of new devices upon which success of highly complicated and delicate machinery in the hands of inexpert users must depend, exercises the greatest caution, and things new, whatever their theoretical virtue, will not be considered until they have been subjected to the most rigorous practical tests for efficiency and durability. [fol. 2390] This must be so when failure of one year's product may bring tremendous losses or complete disaster.

So also with respect to the presumption that attaches to the validity of a grant by the Patent Office. Where, as in this case, substantially all pertinent prior art has been cited against the patent, where in hard fought interferences novelty and invention have been challenged, and where priority of conception has been finally adjudicated only upon repeated review in both administrative and judicial forums, the patent should not be stricken down except upon very clear and convincing proof of invalidity. The weight to be given this presumption has been so recently and so thoroughly discussed, and the rule stated in all the varying formulae by which courts have announced and affirmed it, in Radio Corporation v. Radio Laboratories, 293 U. S. 1, that it is unnecessary here to repeat or to cite additional cases.

In what we have said thus far it is perhaps clear that in respect to novelty and invention over recorded prior art we have concluded the Gulick patent to be valid. But this is not the whole controversy with respect to it. It is the contention of the defendant that the Gulick patent is invalid because abandoned by him prior to his application, and because it had been in public use in this country for more than two years before such application within the purview of R. S. §§ 4886, 4920. The Master so held. His findings were based on the fact that Gulick's 1911 and 1914 pistons had been scrapped, and on inference that Gulick's expressed satisfaction with his 1914 experimentation was conclusive

of the completion of his invention in that year. That there had been no formal abandonment or disclaimer is clear. The Master's findings are based upon constructive abandonment deduced from the above circumstances and delay in applying for a patent.

Questions relevant to actual or to constructive abandonment of inventions are questions of fact, Walker, 6th Ed., § 152; Kendall v. Winsor, 21 How. 330, and much weight must therefore be given to the findings of the Master, who saw and heard the witnesses. Consideration should also be given to the rule that concurrent findings of Master and Judge should not be set aside except for clear error, although this may prove to be an unsafe guide to just decision where exceptions to a Master's report are unilluminated by oral argument and a decree entered without elucidation of the reasons upon which it is based. The law, however, in reference to abandonment, requires that every reasonable doubt relevant to any such question should be resolved in [fol. 2391] favor of the patent, for it does not favor forfeiture. Walker, § 152 and cases there cited. It was said by this court, Gear Grinding Machine Co. v. Studebaker Corp., 270 Fed. 934, 936: "Abandonment depends upon intent, actual or imputed. The actual intent did not exist, and the circumstances do not require that the intent be by law imputed as against the truth." That Gulick did not intend to abandon the subject matter of his invention seems to us clear. From the beginning of his experimentation in 1911 he made drawings from time to time, tests with slotted iron pistons and later with slotted aluminum pistons, and was at the same time not only busy in the earning of a livelihood but with plans for the purchase from a receiver of the property of the Amplex Motor Car Company. The scrapping of his experimental pistons was without his knowledge or consent, and the fact that he replaced the experimental pistons of the Renault car with standard pistons before its sale negatives any inference that the experimental pistons were intended to be abandoned. Distinction must also be made between abandonment of the subject matter of a patent and abandonment of crude experimental devices. While Gulick variously expressed satisfaction with the performance of his experimental pistons, it is clear upon review of his entire evidence that what he had then in mind was that they performed satisfactorily in reference to clearance. They had not demonstrated their strength and durability,

or that they were properly designed or machined for commercial use.

The Master was largely influenced by the fact that Gulick's clarification of his testimony followed a recess, and gave little credence to it. We have reviewed it carefully. That Gulick's experiments were not completed to the end that a practical piston had been fully designed and tested seems clear. He is in some respects corroborated and in no wise impeached. Mere suspicion as to his good faith is not such clear and convincing proof of abandonment as will satisfy every reasonable doubt and sustain the heavy burden which rests upon those challenging the validity of his patent. The Master did not apply to the evidence on the issue of abandonment that standard of proof required to establish it and so the question is one of law, and the finding must be rejected.

There was no public use of the Gulick invention more than two years prior to the application so as to invalidate the patent. So long as use by the inventor can fairly be considered experimental and collateral to the development of the invention in its complete form, the bar of the statute does not begin to run. Reo Motor Car Co. v. Gear Grinding Co., 42 Fed. (2d) 965 (C. C. A. 6). The emphasis that [fol. 2392] is laid upon Gulick's use of a car with experimental pistons for business and pleasure for a considerable period does not impress us. Road tests of many thousands of miles are considered necessary to determine the efficiency of an engine and its parts. That such transportation is not wasted does not of itself constitute a public use. As was said in the second Gear Grinding case: "We see no principle in the precedents or in the policy of the statute which would require a valuable invention to be lost by permitting the bar to begin to run while the invention * * * is being gradually improved and developed up to the point of ascertaining whether it has real utility. Nor can it rightly be said that a public use of a developing and incomplete invention—incomplete as finally claimed—can nevertheless operate as a public use bar because adding the final element of perfection did not involve invention as compared with the earlier form to which it was added."

We are not convinced that the Gulick application was broadened to include new matter after intervening rights had arisen. This issue was adjudicated in the Court of Appeals of the District of Columbia, 17 Fed. (2d) 365, and

the Court of Customs and Patent Appeals, 47 Fed. (2d) 366, 367. With the conclusions there reached we agree. As to the Monckmeir and Schoengarth prior uses, it is sufficient to say without analysis of the voluminous evidence, that they rest mainly upon the uncertain memory of witnesses testifying long after the event, and this does not rise to the dignity of proof requisite to establish prior use. Barbed Wire Patent Case, 143 U. S. 275; Eibel Process Case, 261 U. S. 45.

Jardine, upon an application filed March 11, 1920, claimed an invention of which the chief object was construction of a light alloy piston which would operate satisfactorily at all temperatures and lend itself to economic methods of manufacture. He cut away all the skirt portions of the webs, extending the latter to nearly the length of the skirt parts or slippers. Horizontal slots partially insulated the slippers from the head and these were split vertically to render them yieldable to contact with the cylinder wall. The head was integrally connected to the skirt only in the region above the bosses. His thought was that since heat expansion tends to increase the diameter of the piston in a direction parallel with the wrist pin bosses, when the skirt around the bosses is removed, the central part of the web is free to move while its ends are restrained and resisted by the skirt faces in contact with the cylinder wall. There is insistent challenge and as insistent defense of the valid-[fol. 2393]-ity of Jardine. On the one hand it is urged that Jardine is but the slipper structure of Ricardo patent No. 1,294,833, and that it involved no invention to merely slit vertically its skirt parts as disclosed by Gulick and others. The response is that Jardine discloses a combination of inter-related operating parts that goes far beyond Ricardo, is economical to construct and carries the Gulick concept an important step forward. Jardine indicates the forces, thermal and mechanical, which bear upon the flexible web to compensate for heat expansion of the cylinder head, pointing to the web as being in effect a cantilever structure, weakest at its supports. Jardine came to the attention of the Aluminum Company and the Maxwell at a time when Ricardo and other English engineers were trying to modify the Ricardo piston to meet the piston problem. It was thought to give great promise. Tests had been made and commercial manufacture planned when the Maynard piston was presented to them. It appeared so much better that

the construction illustrated and described by him was adopted. Since it is the Maynard specific form embodying the basic concept of Gulick that made commercial piston history, since Jardine was without substantial commercial recognition and none of the accused devices are slipper pistons, since whatever Jardine contributed to the art, if anything, is said to be incorporated in Maynard and since the really important infringement is said to be the copying by the defendants of the commercial embodiment of Marynard, we feel under no necessity at this time of ruling upon the validity of the Jardine patent or the fact of its infringement.

Maynard upon a patent application filed January 3, 1931, embodies the Gulick combination of skirt insulation, skirt flexibility by means of vertical slotting cooperating with longitudinal slotting, and flexible webs in the region of the wrist pin bosses. He also follows Jardine's simplified design to permit economical manufacture and Jardine's boss relief. The Maynard piston, however, is not a slipper piston. While Jardine carried the webs nearly to the bottom of the skirt and omitted all of the skirt on the web faces, Maynard provided webs about two-thirds of the length of the skirt and continued the latter circumferentially below the webs except for a single vertical slot throughout one bearing face of the skirt. This structure increased the effect of heat on retarding the expansion of the piston so as to permit of a narrowed web. The upper part of the skirt, which reaches higher temperature, is provided with greater compensation against heat expansion by having its [fol. 2394] periphery interrupted by relief about the bosses. The lower part of the skirt requires no interruption of its periphery other than the vertical slot because it receives less heat. This results in a better bearing surface and means additional to the piston rings for closing the passage between the piston and the cylinder wall. It is clear that Maynard, while not departing from the teaching of Gulick in basic combination of elements, discloses a piston lighter and more economical of manufacture than Gulick and one more rugged and durable than Jardine. That the Maynard piston had a very great effect upon the industry and substantially advanced the art, there can be no doubt upon this record. In the precise form disclosed by Maynard and depicted in his drawings, many thousands were

made and successfully used. In a somewhat modified form its production and use has run into very many millions.

Little is claimed for Mooers and Schmiedekneeht, and while some of the claims of each may possibly read on some of the accused structures, they have apparently no commercial history and have not substantially advanced the art. We do not pass upon them, and apprehend that the real controversy here is in respect to validity and infringement of Gulick and Maynard.

Of the devices charged to infringe, the one of prime importance to the plaintiff is undoubtedly the Sterling piston, exemplified by Exhibit 1. The defendants seek to avoid infringement by this structure, which with slight modification, follows the drawings and description of the Maynard patent, and without change, the commercial structure of the plaintiff's licensee, by the contention that its webs are rigid at the top and thus it is distinguished from Maynard, compensation for rigidity being achieved by reducing the thrust faces of the piston skirt at an angle to the vertical sides of the web, giving to the relief in the region of the bosses the so-called "keystone" configuration. But there are no limitations in the claims in suit as to the region of flexibility in the webs, and if the keystone relief provides greater flexibility at the union of the webs with the skirt, it is but a difference in degree, and not one of mode of operation or result and will not avoid infringement. In comparing commercial embodiments of invention with the drawings of patents it is not unusual to find that without departing from the teachings of the inventor improved operation may result from some modification of the disclosure. This court has indicated, Gordon Form Lathe Co. v. Walcott Machine Co., 32 Fed. (2d) 55, 61, that superiority of operation, even when brought about by a valuable improvement [fol. 2395] which perhaps was patentable as such, will not of necessity negative infringement, citing Schiedel Toy, etc., Co. v. Clark, 217 Fed. 760, 771, Toledo Machine & Tool Co. v. E. W. Bliss Co., 287 Fed. 443, 447. The Gordon and Redlin patent there considered was in a true sense a pioneer patent and entitled to broad equivalents, but this does not mean that meritorious inventions which substantially advance the art are entitled to no reasonable range of equivalency. As was said in Eibel Process case, supra, at 63: "Eibel made a very useful discovery which has substantially advanced the art. His was not a pioneer patent

creating a new art; but a patent which is only an improvement on an old machine may be very meritorious and entitled to liberal treatment. Indeed, when one notes the crude working of machines of famous pioneer inventions and discoveries, and compares them with the modern machines and processes exemplifying the principle of the pioneer discovery, one hesitates in the division of credit between the original inventor and the improver; and certainly finds no reason to withhold from the really meritorious improver, the application of the rule *'Ut res magis valeat quam pereat'* which has been sustained in so many cases in this court." A careful consideration of the patents to Gulick and Maynard, an analysis of the claims of each in suit, and a review of the evidence as to principles and modes of operation, lead us inevitably to the conclusion that the Sterling piston (Exhibit 1) infringes the claims in suit of both, and that such minor differences as appear in the commercial embodiment of Maynard, with which Exhibit 1 is identical, do not fall without the reasonable range of equivalents to which the inventors' contribution to the advancement of the art entitle them.

In the remaining accused devices we find no infringement. True, there is similarity. Here and there are identical elements, singly and in combination, but the complete combination upon the conception of which we found Gulick and Maynard to denote invention, does not in any others appear, and so it must be said here as in Gear Grinding Machine Co. v. Studebaker Corporation, supra, in reference to such situation: "It is the patentee's necessary dependence upon the co-operation of all the elements in one machine in order to make the claims valid that also makes this achievement possible."

We find claims 1, 11, 12, 13, 15, 18, 30, 33 of Gulick and Maynard patent in respect to all of the claims sued upon valid. We find such claims to be infringed by the Sterling piston exemplified by Exhibit 1. The decrees below are set aside and the causes remanded for the entry of decrees [fol. 2396] granting the usual relief of injunction and accounting in respect to such infringement as has been found and dismissing the bills with respect to the alleged infringements of Jardine, Mooers and Schmiedeknecht, without prejudice. Costs of appeal will be borne by the defendants.

[fol. 2397] CAUSES ARGUED AND SUBMITTED—April 7, 1939

(Before Hicks, Simons and Allen, JJ.)

These causes are argued by Arthur C. Denison and F. O. Richey for The Cleveland Trust Company and Chrysler Corporation, and by John H. Sutherland and John H. Bruninga for The Schriber-Schroth Company, The Aberdeen Motor Supply Company and The F. E. Rowe Sales Company, and are submitted to the court.

DECREE #7223—Entered October 6, 1939

Appeal from the District Court of the United States for the Northern District of Ohio.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Ohio, and was argued by counsel.

On Consideration Whereof, It is now here ordered, adjudged and decreed by this Court that the decree of the said District Court in this cause be and the same is hereby reversed and remanded for further proceedings in conformity with the opinion of this court.

[fol. 2398] DECREE #7224—Entered October 6, 1939

Appeal from the District Court of the United States for the Northern District of Ohio.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Ohio, and was argued by counsel.

On Consideration Whereof, It is now here ordered, adjudged and decreed by this Court that the decree of the said District Court in this cause be and the same is hereby reversed and remanded for further proceedings in conformity with the opinion of this court.

DECREE #7225—Entered October 6, 1939

Appeal from the District Court of the United States for the Northern District of Ohio.

This cause came on to be heard on the transcript of the record from the District Court of the United States for the Northern District of Ohio, and was argued by counsel.

On Consideration Whereof, It is now here ordered, adjudged and decreed by this Court that the decree of the said

District Court in this cause be and the same is hereby reversed and remanded for further proceedings in conformity with the opinion of this court.

[fol. 2399] Opinion—Filed October 6, 1939

[fol. 2400] [Stamp:] Filed October 6, 1939. John W. Menzies, Clerk

Nos. 7223-24-25, 8094-95-96

United States Circuit Court of Appeals, Sixth Circuit

No. 7223

The Cleveland Trust Company, Chrysler Corporation, Appellants,

v.

The Schriber-Schroth Company, Appellee

No. 8094

The Schriber-Schroth Company, Appellant,

v.

The Cleveland Trust Company, Chrysler Corporation, Appellees

Appeals from the District Court of the United States for the Northern District of Ohio, Eastern Division.

Decided October 6, 1939

Before Hicks, Simons and Allen, Circuit Judges

Simons, Circuit Judge:

Our former opinion in this much litigated patent controversy involving automobile pistons is reported at 92 Fed. (2d) 330, under identical style, but including disposition of the companion cases brought by appellants against the Aberdeen Motor Supply Company, No. 7024, and the F. E. Rowe Sales Company, No. 7025. The Supreme Court, after denying certiorari and a petition for rehearing, received the

cases upon a second rehearing petition and reversed with remand to us for consideration of questions presented and not determined, Schriber-Schroth Co. v. Cleveland Trust [fol. 2401] Co., 305 U. S. 47; directions amended, 305 U. S. 573.[1] A second group of appeals (8094, 8095, 8096) from decrees against appellees in the first case, responsive to our decision therein, is now consolidated for consideration with the reconsideration required by the order of remand.

The claims of five patents, and a number of infringing devices, were in the first instance presented for adjudication. In their consideration we were greatly impressed by the story disclosed by the record of the long search and sustained effort on the part of exceptionally competent automotive engineers to completely solve the problem of a successful aluminum piston operating freely with minute clearances in an iron cylinder. There had been advances, "foreshadowing," perhaps, that solution would not always defy inventive genius, though on the whole the aluminum piston as heretofore noted had received a "black eye" in the industry. Much had been expected of a piston invented by one Jardine, and it was about to be put into commercial production when a design disclosed by Maynard, which seemed an improvement thereon, was produced by the appellants' licensee, was accepted by major companies in the industry, and went into use to the number of many millions. In analyzing the Maynard invention it appeared to us that however meritorious certain structural improvements might be, it nevertheless embodied the basic concept of the patent to Gulick owned by the appellant and in suit. We held certain claims of Gulick and Maynard to be valid and infringed without passing upon the intermediate disclosure of Jardine though recognizing that Jardine may have made substantial contribution to the art.

Observing that many if not all of the elements of the Gulick combination were old, we held his precise combination to be novel and to have the quality of invention, and that its reproduction by the appellees in the specific form disclosed

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[1] The Supreme Court granted certiorari after twice denying it on the ground that conflict was improbable because of the concentration of the automobile industry in the Sixth Circuit. It might be interesting to explore the availability of the Declaratory Judgment Act to dealers in other circuits to raise conflict.

by Maynard was infringement of both. In a recital of the Gulick achievement in terms of elements, function and result, we assigned to the webs of Gulick the rigidity proclaimed by his specification in the dimension in which they furnished "a particularly strong support for the bosses," but a lateral flexibility in the dimension wherein rigidity appears not to have been required, where it would not serve [fol. 2402] the purpose announced, and where it would appear to interpose an obstacle to the expected functioning of a split skirt. There was assumption that since the specification was addressed to those skilled in the art, a purpose to provide a particularly strong support for the bosses was fully served by vertical rigidity, and made implicit in the original specification a lack of rigidity otherwise. With this view we found no difficulty in agreeing with the tribunals that sustained the Gulick amendment reciting lateral flexibility as mere clarification.

The Supreme Court, concluding that Gulick's failure to describe the flexible web element as a feature of his invention, and his failure in this respect to explain the principle of his machine so as to distinguish it from prior art, did not conform to R. S. Sec. 4888, held that his amendment added new matter beyond the scope of the device described in the application as filed, in consequence of which the appellant might take no benefit therefrom. Assuming that we sustained certain claims of his patent only by reading into them the flexible web element, it reversed our decision as to Gulick, and since Maynard neither claims nor describes flexible webs, it likewise reversed our decision as to its validity and infringement. Reciting, however, that since it had been thought by us that full recovery could be had by the appellants under the two patents adjudicated, we did not decide other questions involved in the appeals, it remanded the causes to us for further proceedings "with respect to such claims of the patents in suit as appellant below submitted to that court for adjudication." Upon petition for rehearing and clarification, it added to the direction for judgment the following: "On the remand the Court of Appeals will be free to consider whether the amendments to the Gulick application rendered void the patent issued upon it, and to consider all questions affecting the validity and infringement of the claims in suit of the Gulick and Maynard patents, but without including web flexibility or

laterally flexible webs as an element in the combinations patented by them."

Controversy has arisen over the scope of the remand, the appellees contending that we are precluded from consideration of the Jardine, Schmiedeknecht and Mooers patents since the bills stand dismissed as to them, albeit without prejudice, so that they may be brought to us for consideration only by new actions. The order of remand is, however, specific, requiring no interpretation. We are directed to take further proceedings with respect to such claims of the patents in suit as appellants submitted to us for adjudi- [fol. 2403] cation, not merely in respect to those adjudicated. The phrasing of the amended direction is one of enlargement and clarification and not of limitation. That decrees have been entered below dismissing the bills as to the three patents not considered is of no moment. These decrees are brought into question in appeals 8094, 8095 and 8096 here involved. If they are in conflict with conclusions now reached they must be set aside and our mandates recalled, just as they must be set aside as in conflict with decision above. We hold that the remand operates to reopen the entire cause except insofar as questions necessary to decision have been decided by the Supreme Court and insofar as our own conclusions have not there been held erroneous and so constitute the law of the case.

The first question that confronts us is in respect to the validity of the claims of the Gulick and Maynard patents as circumscribed since we are now obliged to consider them without reading into them web flexibility or laterally flexible webs as an element, and in this connection it seems immaterial whether we read an element into them, or merely construed an existing element as having in its environment a given characteristic. We recognized in our first opinion that Gulick was for a combination of elements, many if not all of which were old. Yet the combination appeared to us to be novel and to denote invention since a new result was secured in consequence of a nicely balanced flexibility of piston skirt, permitting successful operation at minute clearances without bending concentration at any point to impair ruggedness, and so distinguishing from Franquist and other pistons. In a case not free from doubt, since probably no one has seen an automobile piston reciprocating in its cylinder under operating conditions, the success of the commercial embodiment of Maynard, comprehending what was

then conceived to be Gulick's basic concept, after so much failure, clearly appeared to denote that somewhere was invention. But the Gulick conception as we then considered it was of balanced flexibility derived from interplay of yielding skirt periphery and flexing supporting webs in response to the mechanical force of the cylinder wall and the thermal expansion of the piston head. The combination we are now obliged to consider is one with rigid webs opposing their rigidity to the resiliency of a skirt slotted to accommodate itself to forces to which practically it may not yield. This is not the combination we held to be valid. It is not the combination to which those most captious and skilled in the [fol. 2404] industry gave tribute, to the end that all our doubt as to validity was resolved. We are constrained to hold all of the claims in suit of Gulick invalid as marking no inventive step over prior art. It therefore becomes unnecessary to consider whether his amendments voided his patent since the direction in this respect is but permissive and not imperative. It likewise becomes unnecessary to consider the effect of the disclaimer filed since decision above.

In Maynard there was no emphasis on rigidity of web construction such as was found by the Supreme Court in Gulick, but we are compelled nevertheless to view the Maynard combination as one failing to disclose cooperation of flexible webs with vertical and longitudinal slotting to secure the balanced flexibility conceived to reside in Gulick, and constituting therein a basic achievement and since it is apparent that details of construction recited by us as disclosing a piston lighter and more economical of manufacture than Gulick and more rugged and durable than Jardine made no impression upon the court as marking inventive steps over prior art, we are likewise constrained to hold the claims of Maynard in suit invalid.

In the conviction that the long search for a solution of the aluminum piston problem by engineers of great ability, their repeated failures, and the ultimate success of the Aluminum Company's commercial device point with persuasiveness to the fact that somewhere in the search one, with the spark of genius denied the skilled mechanic, contributed to the art the thought that brought achievement out of failure, we reconsider the Jardine patent, for though we are as sensitive as is the Court of Appeals of the Second Circuit [Buono v. Yankee Maid Dress Corp., 77 Fed. (2d) 274, 276], to "the high standard demanded for inven-

tion by the decisions of the Supreme Court in recent years," attested by many of our more recent decisions, yet we also share Judge Learned Hand's understanding that the Supreme Court has not departed from the principle that recourse must be had in doubtful cases to the history of the art for the interpretation of claims and the existence of invention.

The patent to Jardine, 1,763,523, was issued June 10, 1930, upon an application originally filed March 11, 1920, prior to the filing of the Gulick amendment in 1922, now held to be invalid. Jardine with great clarity and in precise detail explains the principle of operation of his machine and the flexibility of its webs. The knowledge that was not Gulicks or was by him concealed, is clear to Jardine and by him proclaimed. "The webs 6 and guide [fol. 2405] segments preferably are so designed that this displacement of the segment 10, 10^a, is permitted by virtue of a bending of the webs 6 at points remote from the guide segments. To this end, as shown in Fig. 4, the thickness of the guide segments is increased toward the webs 6 and the webs 6 are decreased in thickness from the guide portions inward toward the bosses to points in line with the inner ends of the slot 11^a. This gives in effect a cantilever structure weakest at its support. * * * Thus the reaction force of the cylinder wall on the outer faces of the guide segments as the piston expands tends to cause bending of the webs 6 along said line 13. Due to the bending of the web sections 6 and the forcing together of each pair of segments, the guide part of the piston may undergo a considerable thermal expansion without a corresponding increase in the outer diameter thereof and thus a small initial clearance can be used without danger of scoring or seizure of the piston."

Jardine is also the first to refer specifically to an "aluminum alloy piston," and he states that one embodying his invention "can be fitted to the engine cylinder with a very small clearance, and that compensation for the relatively large thermal expansion of the guide section of the piston is provided by the displacement of the guide segments which results from the reaction force of the cylinder wall on the outer faces of the guides." It is true that the drawings of Jardine depict what is known as the slipper type of piston, illustrated also in the patent to Ricardo, No. 1,294,833, but his invention is not limited to that type,

for he says: "It is to be understood that the invention is essentially applicable to other forms of construction."

While the specimen claims of Jardine 1, 8 and 11, though reciting the web as an element do not incorporate therein the property of flexibility, yet in the light of the description they must be so interpreted, for it is clear that the Supreme Court in reversing our decision departs not at all from the rule that claims must be read in the light of the specification, since it is pointed out with particularity in respect to Gulick that his specifications point to no inadequacy in the structure or function of webs of the prior art which would be remedied by the webs specified, and to no function to be performed by them other than as a means of connecting and holding head and skirt so as to maintain the air gaps between them and to support the wrist pin bearings. Jardine repels this criticism of the Gulick application. It is also pointed out that Gulick failed to explain [fol. 2406] the principle of his machine so as to distinguish it from the prior art. Jardine points to prior art failure. "I have found," he says, "that these difficulties can be overcome by constructing a piston with its skirt or guide portion supported and slotted or divided in a manner to permit deformation and deflection of parts thereof without interfering with the performance of the essential functions of the respective parts."

To invalidate Jardine the appellees rely mainly upon the Long piston and Long's patent No. 1,872,772, upon an application prior to Jardine's, and emphasis is placed upon the observation of the court to the effect that the Long piston, with webs concededly flexible laterally, was in commercial use in 1922. This brings us to a consideration of the contention, vigorously urged by the appellants, that the Supreme Court having applied to the sufficiency of disclosures made by Gulick and Maynard the so-called strict rule of construction, an equally strict rule must be applied to prior art. To this the appellees reply that there is a distinction between the teachings of a prior art patent or publication and a prior use. They concede that the description in patent or publication must be complete when read in connection with the prior art as one skilled in the art would read it, but urge that when it comes to a prior use, and an article is in existence so that it may be duplicated, it is immaterial whether those skilled in the art knew or were unaware of its characteristics.

Recognizing distinction between what may be disclosed in a patent and what may appear to the understanding of those skilled in the art when it reaches commercial embodiment and so may be physically reproduced, yet it would seem to us that nothing is prior art, at least in respect to function, unless its function is understood by those skilled in the art. Otherwise there would be little support in reason for the rule that novelty is not negatived by any prior accidental occurrence or production the character and function of which was not recognized until later than the date of the patented invention sought to be anticipated thereby, 1 Walker, 6th Ed. Sec. 106, or the further rule that novelty is not negatived by anything which was neither designed nor apparently adapted, nor actually used, to perform the function of the thing covered by the patent, Idem, Sec. 107. Nor is the observation of the court that a Long piston was in commercial use in 1922, the webs of which were concededly flexible, to be taken as a conclusion that the webs were flexible in use or that their flexibility, cooperating with [fol. 2407] other resilient elements, was then understood, however clear it may later have come to be. The Long patent did not disclose flexible webs. Since the argument that the webs of Gulick were laterally flexible to the understanding of those skilled in the art was rejected, so must we reject inference that prior to Jardine the art understood the webs of Long to be flexible in the absence of clearly convincing evidence that they were known to have that quality. Moreover, the Long patents recite that the separated portions of the skirt are rigidly held against bending to the forcing thrust of the piston. A Long piston was introduced to the industry by advertisement in The Motor World, December, 1921. It was installed in the Franklin automobile, and use at a clearance of .005 was set forth in a service bulletin. The evils following clearance so great are sufficiently recited in our former opinion, and the announced clearance negatives the thought either of web flexibility or of its understanding by the art.

It is said that pistons could not in an air cooled motor as was the Franklin, be machined to the minute clearance possible in water cooled motors. If true, it follows that Long contributed little to the solution of a problem whereby successful operation of an aluminum piston in an iron cylinder at clearances of .002 or less was achieved. It should, moreover, be noted that Long was a worker in the piston art for a considerable period. Three of his patents are in

the record. It is conceded that No. 1,872,772 was his best effort, yet the structures urged to anticipate Jardine were devices prior to it, and while they may have had some commercial history, his latest patent still failed to describe or claim with flexibility.

Hartog, in his patent No. 1,842,022, prior to Jardine, claims internal yielding ribs, and means for yieldingly connecting skirt sections with the head. It seems clear from the Hartog description and drawings that his thought was of a springing resiliency in arcuate extensions of his skirt sections, and not of the bending or flexing of straight ribs so proportioned as to yield to the thermal expansion of the bosses on the cantilever principle, and that he did not disclose Jardine's mode of operation. There is little in the record to aid us to an understanding of Hartog. The experts did not discuss it, and the appellees appear to place no great reliance upon it. It is a mere paper patent without influence upon the art, and it is difficult, if not indeed impossible, to comprehend its mode of operation or whether it is operable at all, since he describes a piston skirt of greater diameter than the cylinder, mechanically compres- [fol. 2408] sible when cold, to fit tightly therein. Hartog taught nothing to Jardine.

The specimen claims 1, 8 and 11 of the Jardine patent are valid. Since our conclusion in this respect is based upon the concept of a combination with balanced skirt flexibility due to cooperation of longitudinal and vertical slotting with flexing webs supporting retracted bosses and connected to a skirt thereby made responsive to physical compression and thermal expansion so as to permit of minute clearances between piston and cylinder, a concept perceived in Gulick as amended and minus amendment no longer perceived, and since this combination with modifications which may improve but do not destroy it appears in Jardine, and since it is the combination that appears in the commercial piston of the Aluminum Company of America [2] responding to Maynard's specific form

[2] We are no more concerned than was the master below with the character of the monopoly sought by the appellants' licensee. Monopoly is the essence of the inventor's reward, and an assignable property right. Its control, abridgment or destruction lies wholly within the legislative province.

and in such form reproduced by Sterling Products Co., in exhibit I, sold by the appellees, we hold that the latter infringes claims 1, 8 and 11 of Jardine. As we were unable in our first decision to find Gulick's complete concept, as we then understood it, in other accused structures, so are we now unable to find in them Jardine's concept, and we hold they do not infringe.

The Mooers patent 1,402,309 was not greatly stressed in the earlier briefs or argument. It is not strongly urged now. It is contended that Mooers disclosed the scheme for converting heat into mechanical energy and diverting expansion through this energy into relieved spaces limiting expansion in those unrelieved. But if this is the teaching of Mooers it must be derived from inferences not permitted to be drawn from Gulick and Maynard, and without such interpretive approach the conclusion must be that the Mooers disclosure is incomplete. We hold its specimen claims to be invalid.

Schmiedeknecht patent 1,256,265 has now expired. It discloses no web flexibility cooperating with other elements of resiliency to achieve the balanced flexibility perceived in Jardine on the basis of which alone the latter is thought to be valid, and we sense no advance in Schmiedeknecht that distinguishes it from the prior art in aspects beyond the skill of the art. It does not invalidate Jardine and is itself invalid.

Appeals 7223, 7224 and 7225, are from decrees in the same causes determined by our previous opinion, and re- [fol. 2409] sponsive to our mandates therein. This unusual situation resulted from the denial of a petition for certiorari to our first judgment and denial of a petition for rehearing thereon. It was doubtless assumed below that the cases had reached finality. The decrees adjudicated certain claims of Gulick and Maynard valid and infringed by exhibit I, and granted the usual injunction and order for accounting. The issue as to them is now moot, and our mandates must be recalled and the decrees set aside.

The appellants, however, contend that the decrees should not have provided injunctive relief to the appellee Trust Company on the ground that it is the bare title holder of the patents in suit, with the Aluminum Company of America as exclusive licensee the only party entitled to seek it. They thereby deny our power to grant restraint in respect to claims now found valid and infringed. The

master, however, concluded that the Trust Company holds the entire right, title and interest to all patents in suit except an undivided half of the Maynard patent, that it might sue in its own name without joining with it the beneficiaries under the trust, and that the Aluminum Company is a non-exclusive licensee and not a necessary party to the suit. No exception was taken to his findings or conclusions in this respect, and they were not challenged when the case was first before this court. The right of appellees to injunction was no longer in issue when we gave direction for mandate. It is now the law of the case that appellees are entitled to an injunction restraining infringements of any claims of any of the patents in suit now adjudicated as valid and infringed.

A second objection to the decrees, and so impliedly to similar substituted decrees, is that they were not specific. It is urged that they should have recited with particularity the exhibits held to infringe, and those held not to infringe. There is merit to the first phase of the contention since an injunctional order should be as explicit as the case permits. There is no virtue in the second, since decision carries its own vindication of unsuccessfully assailed structures and no affirmative relief by appellants was prayed.

The decrees below will be set aside upon the recall of the mandates. A new decree will be entered in each case adjudicating claims 1, 8 and 11 of Jardine patent valid and infringed by exhibit I. It will provide for an injunction restraining manufacture, use and sale of exhibit I, and all substantial equivalents thereof, and grant the usual [fol. 2410] accounting for past infringement by exhibit I or its equivalents. It will deny relief as to every other claim of any of the patents in suit, and as against all other accused structures. Costs of the appeals will be divided.

Reversed and remanded for further proceedings in conformity herewith.

[fol. 2411] PETITION FOR REHEARING—Filed November 4, 1939

[fol. 2412] Nos. 7223-24-25, 8094-95-96

UNITED STATES CIRCUIT COURT OF APPEALS, SIXTH CIRCUIT

No. 7223

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Appellants,

v.

THE SCHRIBER-SCHROTH COMPANY, Appellee

No. 7224

SAME

v.

THE ABERDEEN MOTOR SUPPLY COMPANY, Appellee

No. 7225

SAME

v.

THE F. E. ROWE SALES COMPANY, Appellee

No. 8094

THE SCHRIBER-SCHROTH COMPANY, Appellant,

v.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Appellees

No. 8095

THE ABERDEEN MOTOR SUPPLY COMPANY, Appellant,

v.

SAME

No. 8096

THE F. E. ROWE SALES COMPANY, Appellant,

v.

SAME

PETITION FOR REHEARING

To The Honorable The Judges of The United States Circuit Court of Appeals For The Sixth Circuit:

While we are loath to ask the Court for further consideration of these cases, the contentions which our adversaries

have made and may make in a companion case are such, we [fol. 2413] think, that if this Court is reminded thereof a modification of the decision rendered October 6, 1939, will be made.

We urged, in our Briefs and argument before this Court, that any decree entered in these cases should recite with particularity the devices held to be non-infringing. But this Court has said there is "no virtue" in our contention because

"decision carries its own vindication of unsuccessfully assailed structures * * *" (Dec. p. 10).

While in the ordinary case the decision might suffice for the purpose, there are special circumstances here which, to the end that future controversy may be avoided, impel us to ask that extra precaution be taken that the decrees below are specific in every particular.

1. The character of the devices held non-infringing cannot be ascertained from the decision. The only references made, in this Court's decision, to the non-infringing devices are:

Page 9: "* * * As we were unable in our first decision to find Gulick's complete concept, as we then understood it, in other accused structures, so are we now unable to find in them Jardine's concept, and we hold they do not infringe."

Page 11: "It will deny relief * * * as against all other accused structures."

Such "accused structures" are, however, neither illustrated nor described in this Court's decision. They are not even identified by exhibit numbers. How then can another Court determine, in another case, what this Court held to be non-infringing?

2. Counsel for The Cleveland Trust Co. insist estoppel is determined by the decree alone and not by the decision. [fol. 2414] While it is undoubtedly true that the law of this case is that

"decision carries its own vindication of unsuccessfully assailed structures,"

it should be remembered that the questions of estoppel, res adjudicata, and stare decisis, based on this Court's decision,

may, and probably will, arise in other cases. In such other cases the above quotation will not have been established as "the law of the case."

Counsel for the Trust Company will, therefore, be free, in such other case, to contend, as they have already contended in Sterling Products Corporation v. The Cleveland Trust Company, No. 5064* (In the United States District Court at Cleveland), that an estoppel cannot be based on a decision or opinion where the decree is silent.

In the above-mentioned case Counsel for the Trust Company asserted in "Defendant's Rebuttal Memorandum on Defendant's Motion for a Preliminary Injunction" that

"It is a Final Decree Alone which estops."

"Counsel (for Sterling) seek to make a statement by this Court in his *opinion* in the Simmons Suit, grounds for an estoppel against us (Trust Co.)." (Emphasis ours.)

Unless the District Court is directed to include in its decrees a provision to the specific effect that pistons like Exhibits 8, 9, BBB, CCC, 3J and 3-O do not infringe any of the patents in suit, the Trust Company will be free to argue, as it previously did with success, that the reversal set aside the previous decree below holding such pistons noninfringing. Despite the fact that, in its original decision, this Court said:

"In the remaining accused devices we find no infringement."

[fol. 2415] Counsel for the Trust Company asserted:

"The only ruling which the Court of Appeals made upon the question of infringement of Gulick and Maynard by the above numbered pistons, was to set aside the decree below which, in its rulings upon them, held noninfringement of the above numbered pistons. Thus the Court of Appeals annuled the ruling of this Court on noninfringement which the defendants ask the Court to reinstate without any authority in the mandate. It is untenable to say the Court intended to hold that these pistons were noninfringing when it had set aside the same identical holding by this Court" (P. 5, "Plaintiff's Brief on Defendant's Motion for Entry

* One phase of that case was before this Court in No. 7401.

of Final Decrees on Mandate" filed in the Court below December 8, 1937.)

All we hereby ask the Court to do is to direct the District Court to make its decrees particularly specific with respect to what is held noninfringing and thereby forestall the possibility that in the future, through loss of physical exhibits or otherwise, no one will be able to determine what this Court adjudged to be noninfringing. While we have not herein asked for a rehearing upon, or re-presented our arguments with respect to, other contentions as to which this Court has ruled against us, our failure to do so is not to be misunderstood as waiver of our right to seek review thereof.

Respectfully Submitted, John H. Bruninga, John H. Sutherland, Counsel for Defendants-Appellees.

It is hereby certified that the foregoing Petition for Rehearing is believed to be well founded in law and fact, and is not interposed for the purpose of delay.

John H. Sutherland, Counsel for Defendants-Appellees.

[fol. 2416] Order on Petition for Rehearing—Entered November 14, 1939.

Upon application entitled "Petition for Rehearing", filed by the appellees in the above entitled causes,

It is Hereby Ordered that the direction for mandates therein be amended to provide that the *the* decree ordered to be entered in each case will include an adjudication that the structures exemplified by exhibits 8, 9, BBB, CCC, 3J and 3-O, do not infringe any of the claims of any of the patents in suit.

Order Amending Mandate—Entered December 13, 1939

It appearing that the direction for mandate in our opinion in the above cause, announced at the October session of this court, was, upon petition of the appellees, amended so as to make specific the assailed structures held not to infringe, in accordance with which we amended the ordering clause to read:

"That the structures exemplified by exhibits 8, 9, BBB, CCC, 3-J, and 3-O, do not infringe any of the claims of any of the patents in suit."

And it now being called to our attention that not all of the [fol. 2417] claims of each of the patents adjudicated were in issue, and

It having been clearly our intention under command of the order of remand made by the Supreme Court, to determine all questions in the case not adjudicated, but to do no more than that; and

It being our view upon consideration of the response of the appellees to the petition, that the res judicata effect of the present decision upon other litigation now pending should more properly be adjudicated in such pending suits, and that any effort to predetermine the effect of presently ordered decrees upon such suits without consideration of the issues there involved is entirely too speculative for appropriate present adjudication, Now, Therefore,

It is Hereby Ordered that a supplemental mandate be issued in the above cause directed to the District Court, which supplemental mandate shall order that the original mandate heretofore issued, is amended so that the ordering clause therein shall provide in place of what is above recited, the following:

"That the structures exemplified by exhibits 8, 9, BBB, CCC, 3-J, and 3-O, do not infringe any of the claims of any of the patents in suit which they were charged to infringe."

[fol. 2418] UNITED STATES CIRCUIT COURT OF APPEALS FOR THE SIXTH CIRCUIT

I, J. W. Menzies, Clerk of the United States Circuit Court of Appeals for the Sixth Circuit, do hereby certify that the foregoing is a true and correct copy of record and proceedings in the case of The Cleveland Trust Company & Chrysler Corporation vs. The Schriber Schroth Company, The Aberdeen Motor Supply Company, The F. E. Rowe Sales Company, No-. 7223, 7224, 7225, as the same remains upon the files and records of said United States Circuit Court of Appeals for the Sixth Circuit, and of the whole thereof.

In Testimony Whereof, I have hereunto subscribed my name and affixed the seal of said Court at the City of Cincinnati, Ohio, this 3rd day of January, A. D. 1940.

J. W. Menzies, Clerk of the United States Circuit Court of Appeals for the Sixth Circuit. (Seal.)

[fol. 2419] [Stamp:] Office of the Clerk, Supreme Court, U. S. January 6, 1940

SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1939

No. —

THE SCHRIBER-SCHROTH COMPANY, Petitioner,

vs.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION;

THE ABERDEEN MOTOR SUPPLY COMPANY, Petitioner,

vs.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION;

and

THE F. E. ROWE SALES COMPANY, Petitioner,

vs.

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION

Order Extending Time Within Which to File Petition for Certiorari

On Consideration of the application of counsel for the Petitioners,

It is Ordered that the time for filing a petition for writs of certiorari in the above entitled causes be extended for a period of 10 days from Jany. 6", 1940.

J. C. McReynolds, Associate Justice of the Supreme Court of the United States.

Dated this 6" day of January, 1940.

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[fol. 2420] [Stamp:] Office of the Clerk, Supreme Court, U. S. January 6, 1940

SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1939

No. —

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Petitioners,

vs.

THE SCHRIBER-SCHROTH COMPANY;

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Petitioners,

vs.

THE ABERDEEN MOTOR SUPPLY COMPANY;

and

THE CLEVELAND TRUST COMPANY, CHRYSLER CORPORATION, Petitioners,

vs.

THE F. E. [illegible]OWE SALES COMPANY

Order Extending Time Within Which to File Petition for Certiorari

On Consideration of the application of counsel for the Petitioners,

It is Ordered that the time for filing petition for writs of certiorari in the above entitled causes be extended for a period of 10 days from Jany. 6".

J. C. McReynolds, Associate Justice of the Supreme Court of the United States.

Dated this 6" day of January, 1940.

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[fol. 2414] SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1940

No. 9

ORDER ALLOWING CERTIORARI—Filed March 25, 1940

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Sixth Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

Mr. Justice Roberts took no part in the consideration and decision of this application.

[fol. 2415] SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1940

No. 10

ORDER ALLOWING CERTIORARI—Filed March 25, 1940

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Sixth Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

Mr. Justice Roberts took no part in the consideration and decision of this application.

[fol. 2416] SUPREME COURT OF THE UNITED STATES, OCTOBER TERM, 1940

No. 11

ORDER ALLOWING CERTIORARI—Filed March 25, 1940

The petition herein for a writ of certiorari to the United States Circuit Court of Appeals for the Sixth Circuit is granted.

And it is further ordered that the duly certified copy of the transcript of the proceedings below which accompanied the petition shall be treated as though filed in response to such writ.

Mr. Justice Roberts took no part in the consideration and decision of this application.

Endorsed on Cover: Enter John H. Sutherland. In Nos. 650-651-652. File Nos. 44,057, 44,058, 44,059, 44,060, 44,061, 44,062. U. S. Circuit Court of Appeals, Sixth Circuit, Term No. 9. The Schriber-Schroth Company, Petitioner, vs. The Cleveland Trust Company, Chrysler Corporation. Term No. 10. The Aberdeen Motor Supply Company, Petitioner, vs. The Cleveland Trust Company, Chrysler Corporation. Term No. 11. The F. E. Rowe Sales Company, Petitioner, vs. The Cleveland Trust Company, Chrysler Corporation. Term No. 653. The Cleveland Trust Company, Chrysler Corporation, Petitioner, vs. The Schriber-Schroth Company. Term No. 654. The Cleveland Trust Company, Chrysler Corporation, Petitioner, vs. The Aberdeen Motor Supply Company. Term No. 655. The Cleveland Trust Company, Chrysler Corporation, Petitioner, vs. The F. E. Rowe Sales Company. Petitions for writs of certiorari and exhibit thereto. Filed January 16, 1940. Term Nos. 9 O. T. 1940. 10 O. T. 1940. 11 O. T. 1940. 653 O. T. 1939. 654 O. T. 1939. 655 O. T. 1939.

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